THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE MARCONI CONTRACT.

LAST week the Prime Minister announced the forthcoming publication of the new contract with the Marconi Co., and provisionally fixed a day for the discussion of its terms; but the matter still remains in suspense, and in the meantime the daily Press has been deluged with communications on the subject from amateur "experts" and party politicians.

Prominent amongst these is a long letter from Sir Henry Norman, Associate I.E.E., who is a member of the War Office Wireless Committee and has recently "visited, minutely examined, and taken copious notes of every type of high-power long-distance wireless station in Europe"! So far as he knows, no other person has done this. Sir Henry is to be congratulated upon his remarkable achievement, on the strength of which he imperatively demands the abandonment of the royalty and the formation of a State Department for Imperial Communications. But as a member of a Departmental Committee, would he not show better taste by refraining from polemics in the public Press?

Brushing aside all questions as to the *bona fides* of the parties to the contract—though in passing we may express our unshaken confidence in the integrity and single-minded patriotism of Mr. Samuel—the chief points around which the battle has raged are these: Is the provision of Imperial wireless communication a matter of extreme urgency?—Is it essential that the work should be placed in the hands of the Marconi Co.?—Are the terms of the contract reasonable and just?—Will the contract prove detrimental to the progress of wireless telegraphy and to the national interests?

As regards the first of these questions, we have already expressed the view that we must accept the reiterated statements of the men to whom we have entrusted the duty of safeguarding the defences of the Empire. The British public is notoriously distrustful of the expert, but it cannot afford to ignore his deliberate judgment in a matter of such transcendent importance. Let it be granted, then, that the erection of the Imperial chain is a matter of pressing necessity—how can it be effected with the least delay? The Post Office admittedly cannot undertake the work; the Admiralty will not, even if it can, for its staff is fully occupied with its normal duties, which must not be neglected. It has been proved by the investigations of the Scientific Advisory Committee that of all the possible competitors for the contract, the Marconi Co. is the only concern which has done similar work on a commercial scale, and is in a position to carry out the undertaking at once with a certainty of success—and certainty is a *sine qua non*. There is, to our mind, no alternative.

The third is perhaps the most vulnerable point of the policy of the Government, for it is urged that the royalty is excessive, that it will become a perpetual burden upon the wireless service, that it will enable the company to throttle all competition, and that the payment of the full royalty irrespective of the number or value of the patents in use is a preposterous condition. We need not discuss the pros and cons of the matter, however, for the Postmaster-General on Monday stated that the royalty conditions had been radically changed; the royalty has been split up into

four sections in such a way as to remove its most objectionable features and to enable the Government to reduce the payment on discarding any section, whilst retaining some of the company's patents in use. As the hostility of the opposition to the contract has mainly centred on this question, we may now hope that the contract will be ratified in the course of next week, and that the work of construction will be put in hand without further delay.

As regards the possible effect of the contract upon future progress, there is room for a great deal to be said on either side, but little is to be gained by the discussion. No man can tell what to-morrow may bring forth. There is one factor, however, to which we may direct attention. It is sometimes pointed out that the company, enriched by an extortionate royalty, will be in a position to purchase all rival patents and to establish a virtual monopoly in wireless telegraphy. But is the Imperial service likely to prove as lucrative as is suggested? We doubt very much whether the receipts will assume the magnitude assigned to them. The cable is not yet obsolete, and it is significant that the cable companies are not perturbed at the prospect of the competition of the wireless chain. The Government has sedulously avoided giving any estimate whatever of the probable amount of the gross receipts. It must be borne in mind that the wireless service is devoid of that most important quality—secrecy—and, therefore, that all messages of such a nature as to necessitate secret transmission will have to be sent by cable. No cipher, we are told, is undecipherable, and only by means of a private code can absolute secrecy be secured in wireless transmission. Speed also is an important consideration, and as the wireless messages must be repeated manually at every station, both speed and accuracy will necessarily suffer in comparison with the cable service, which now has at its command automatic repeaters of the highest efficiency. The automatic records of the wireless service will be photographic, and will, therefore, have to be read and transcribed by human agency, which is prone to error.

We believe that the bulk of the public traffic on the wireless system will be of a domestic nature, a class which the cable companies until recently did not trouble to cater for; it must necessarily be cheap, and its development will be of slow growth. During the first years, therefore, the royalty payments cannot assume large proportions, and the company will not possess those boundless resources that are necessary to establish and maintain a monopoly. Moreover, the British Empire does not comprise the whole world, and there is plenty of scope for other concerns to develop their systems beyond the control of the British company. We see no valid reason for the fears which have been expressed on this score, and we sincerely hope that a start will shortly be made with the work.

We are glad to record the fact that the Government has taken steps to form a technical Advisory Committee, somewhat on the lines suggested by Sir Joseph Larmor, and that Mr. W. Duddell has been invited to preside over its deliberations. The choice was no doubt inevitable, but is none the less gratifying on that score. The President of the Institution of Electrical Engineers is probably the most eminent independent expert in wireless telegraphy that we possess, and we congratulate Mr. Samuel on having retained his services on behalf of the nation for a period of years.

Ghent Exhibition.

Our readers probably need no reminder that an International Exhibition is now in progress in Ghent, one of the most interesting cities in the "Lowlands," and one which is particularly easy of access from this country at a trifling cost. The exhibition is a large one, occupying an area of 250 acres, and includes a wonderful representation of a village in "Old Flanders," to mention only one of its varied attractions. We are here concerned, however, not with æsthetics or antiquities, but with the modernities which appeal to the professional sympathies of our readers, and from this restricted point of view we are compelled to state that the list of exhibits presenting noteworthy features is but a very short one. The British Section, as a whole, is a very fine one, well worthy of its origin, and we are informed that the "arts and crafts" section is one of the best collections ever brought together; but the most striking and important exhibits in the Machinery Hall are devoted to the textile industries, which afford examples of electric driving, but are not otherwise of electrical interest. In the International Machinery Hall also there is little for us to comment on, but an annexe to this building, called the Palais d'Electricité, is prettily illuminated, and contains a variety of small electrical apparatus for domestic applications, as well as motors, accumulators, &c.

In the French section a room is set aside for electrical exhibits, which are well set out, though perhaps rather crowded, and there are a few items in the German section.

While the Board of Trade Exhibitions Branch has, undoubtedly, afforded very valuable assistance to exhibitors, it is, we think, very questionable whether the holding of two exhibitions in the same country within a period of two years is not overdoing the thing. We understand that many of the British exhibitors were anxious to be represented at Ghent, no doubt remembering the successes they recorded at Brussels, but we suggest that, while under similar circumstances such firms should be amply supported by the Branch, the question whether British manufacturers should receive a general and pressing invitation to exhibit and thus to form a large British Section should receive very careful consideration. We are not in possession of all the facts that led the Branch to adopt this course, and it is too soon yet to take stock of the results; but we think we shall voice the opinion of manufacturers in general in propounding the view that at least five years should elapse before one of its international exhibitions follows another in any one country, and preferably a longer interval should be allowed.

The First Municipal Waste Heat Station.

Elsewhere in this issue we illustrate and describe the new exhaust-steam generating station of the West Hartlepool Corporation. The scheme is the first of its kind to be carried out by municipal enterprise, and its novelty in this connection led to very close scrutiny of the proposals by the L.G.B. at the official inquiry, which was concluded in July, 1911.

Under an agreement which lasts for a period of 30 years, the Seaton Carew Iron Co. provides exhaust steam from its blowing engines, or, if none is available, live steam from its boilers, to mixed-pressure turbines provided by the Corporation, as well as the circulating water required by this plant, in exchange for electrical energy to meet its requirements. Various guarantees in the agreement safeguard the Corporation, which also has sufficient adjoining land to build a coal-fired boiler plant in the event of its being necessary to do this.

The immediate effect on the Corporation's electricity supply will be roughly the loss of a large consumer—the Seaton Carew Co.—and the gain of others requiring more than double the lost supply; on the operating side, coal and water costs will practically disappear, but the saving in this direction will necessarily go towards the capital charges on the new plant. Thus it is not probable, and, indeed, Mr. Friederichs, the borough electrical engineer, does not anticipate, that the full benefit of the new plant will be felt for a year or two.

The expected practical disappearance of coal costs, at a time when coal prices promise to remain at a high level, leaves little doubt as to the ultimately profitable character of the scheme, which is welcome, if only on account of the enterprise displayed by the Corporation and its engineer in facing modern electrical requirements in a business-like manner.

Salaries in Public Service.

We find ourselves entirely in agreement with the Chancellor of the Exchequer when he argues for large salaries to be paid to men qualified to hold important positions in the public service. There was a time when not every member of the present Cabinet used to think that way. But the times change and we change with them,

so there is nothing incongruous in thinking when you are young that no man is worth more than £500 a year, and when you get to years of maturity drawing an annual salary of ten times the amount. Yes, we quite agree with Mr. Lloyd George that when, as in the case of the Road Board, men of exceptional standing and ability in matters of organisation and control are called from private occupation to the service of the State, they should be compensated with the hand that is not niggardly. "It was very desirable that they should get the best men available for these positions, and he did not think there was a greater mistake than to underpay them" (*Times* report).

There are, as most people will admit, many things calling loudly for redress in connection with the Civil Service. We have sympathy with the agitation which occasionally arises for less of privilege and more of merit to decide who shall *enter*, but the Chancellor's trouble at the moment concerns the later doings of those who after having proved their fitness are weaned from the service of the State by the attractions of the world. He says: "One of the most serious facts they had to face was that their really good men passed from the Civil Service," for "the moment a man developed first-rate business abilities, it paid big businesses to offer him a large salary, even as much as £10,000." Now, if we were to read much more of this sort of thing we should feel prompted to call for a speech from the Postmaster-General, and inquire into the health of the Telephone Service. It is, no doubt, a crying shame that the business world should attract our State servants by dangling princely salaries before them.

But let us consider another case. Imagine a huge business built up by private enterprise and then bought over by the State for many millions sterling of purchase money. We will decide not to take over any official whose salary exceeds £700 per annum. Efficiency, brains, powers of organisation, expert knowledge of a most intricate business—these shall all be subordinated to that policy of the fixed salary limit. What would the Chancellor of the Exchequer say to that? What *does* the Postmaster-General think of it, in the midst of the bombardment of complaints respecting the telephone service of this year of grace 1913? Perhaps we had better not ask what do the Post Office Engineering Department staff think of it.

Applying the Chancellor's own words in this connection, may we not say that "One of the most serious facts that we have to face is that really good men" of high technical qualifications are not yet appreciated at their proper value, that the status of the Post Office engineer leaves much to be desired? For the Road Board we will have the best men we can get; the telephone—upon which we are going to spend 10 millions sterling more—must take care of itself.

Cooling Gas Engines.

The paper read by Prof. Bertram Hopkinson this week before the Institution of Mechanical Engineers heralds a new era in the history of the gas engine; the novel system of cooling the cylinder and piston, which he describes, will undoubtedly prove of fundamental importance to the internal-combustion engine, especially in the larger sizes, and will very materially modify the relationship between the large gas engine and the electricity supply industry.

Briefly, Prof. Hopkinson has found a way of cooling the parts exposed to the hot gases which will completely do away with the necessity of installing costly cooling towers, pumps, &c., and at the same time greatly simplifies the construction of the engine, as water-jacketed cylinders and pistons will no longer be required. The cylinder will become more simple even than that of a steam engine, for it will need no jacket at all; and with simplicity and the removal of high temperature stresses will come a freedom from cracked cylinders and pistons, which must greatly increase the reliability of the large gas engine. The use of internal cooling also has the rather paradoxical advantage that its absence through the accidental failure of the water supply, instead of wrecking the engine, merely results in a temporary stoppage without any damage—and not even a stoppage, if the mishap is discovered within ten minutes or so of its occurrence. Moreover, the speed of the engine and its output can be increased by a considerable percentage, and possibly its present inability to carry an overload for long may be removed (though the author does not make this claim).

We do not wish to suggest that startling consequences will follow this new and interesting development; but there is no doubt that, assuming the author's claims to be fully realised, it will place the gas-electric power plant in a much more favourable position than it has hitherto occupied in this country. Already the large gas plant challenges the supremacy of the steam plant, and if the cost of the former can be reduced by, say, 20 per cent., and the output increased by a like percentage, it is clear that the balance of economic advantage will be radically altered. The question whether steam or gas power shall be employed in a new generating station will assume an entirely new aspect.

So far as the competition between the electric motor and the small gas engine is concerned, no change need be anticipated, for the cooling of the latter is not surrounded with the difficulties met with in the case of large engines, and the benefit derivable from the new system will be proportionally far less.

An Arbitrary Specification.

A specification recently issued in connection with the electric wiring of the new Mining and Pottery Schools at Stoke-on-Trent, contains clauses which are, in our opinion, both arbitrary and retrograde. In one clause it accepts the model general conditions recommended for use in connection with contracts for electrical work by the Institution of Electrical Engineers, but modifies this acceptance by the phrase "when such conditions are applicable and *not at variance with the provisions herein*."

Amongst these provisions we note that no payments are to be made to the contractor until one month after the completion of the work to the satisfaction of the architect and the engineer, when an amount equal to 80 per cent. of the contract price is to be paid. The work is to be carried out to the entire satisfaction of both architect and engineer, but no plea as to their acts or orders is to be put forward to excuse any error of construction or fitting. If any part of the work fail on test, it is apparently open to the architect totally to reject such work, and to deduct from the contract price the architect's estimated cost of the rejected work being redone by another contractor. According to the letter of the specification, no opportunity is to be given the contractors to put the matter right.

Any claim for extras is to be made in detail by the end of the month in which the work is done, or it will be considered that the claim has been waived.

If the contractor die during the course of the contract, it is open to the architect to proceed as if the firm became bankrupt, getting the work done by other parties, and charging the cost against the estate of the deceased contractor. In our opinion the representatives of the deceased should have the option of completing the contract.

Coming to the work to be done, the descriptions given are very vague, so vague indeed that a meeting was arranged between the contractors and the engineer to elucidate many of the most elementary points. No plan of circuits is given, nor is there a clear definition of the class of cable to be used, while, in some cases, parts of the work are to be done by the builders at the contractor's charge, such charge forming part of the contract sum. It would be possible to give many instances where the specification is too vague for close tendering. Our object is, however, simply to enter a protest against the relapse which this specification illustrates into what we had hoped were the methods of bygone days, when unduly vague specifications coupled with unjustly stringent general clauses made electrical contracting a gamble rather than a business.

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WATER SUPPLY FOR INTERNAL-COMBUSTION ENGINES.

By A. N. RYE.

The supply of cooling water to the cylinder jackets, cylinder covers, exhaust valves, &c., of gas and Diesel engines is a matter which in many cases does not appear to have received sufficient attention. It is, however, one of the most important details, particularly if the engines installed are of considerable power, and it is rather astonishing that many of the makers of this class of plant appear to treat the matter almost with indifference. Possibly under the existing conditions of keen competition they do not consider it advisable to call the attention of buyers to the necessity for installing elaborate and costly water supplies.

Most engineers with steam plant experience are naturally inclined to deal with the cooling water for internal-combustion engines in the same way as they would deal with the circulating water for a surface condenser, but further consideration of the subject will show that the two problems are not similar to one another, and it will also show that a water supply which is quite suitable for surface condensers may be totally unsuitable for internal-combustion engines.

The importance of a reliable supply of cooling water for internal-combustion engines cannot be over-rated; any failure of the circulation may cause a most serious breakdown if not noticed at once. Particularly on Diesel engines, with their fine clearances, it does not require a very great increase of cylinder temperature to cause either a cracked piston-head, cracked cylinder cover, or a seized piston—all of these are expensive accidents, and the latter may cause a complete wreck of the engine. Of course gas engines are subject to the same risks, but for various reasons they appear to be rather less susceptible to ill treatment. Even if the failure of the water supply is noticed in time, it means that the engines involved must be shut down at once, and if overheated they must be allowed to cool down before again turning on the cold water; it is possible to crack an expensive casting by restoring the water supply too quickly. A delay of this nature may cause a serious interruption to the supply. It is, therefore, evident that a reasonable outlay on securing a reliable water supply is a good investment.

It is surprising to see the totally inadequate provision for water supply made by many manufacturers of internal-combustion engines, which are frequently sent out with a small belt-driven pump for this purpose. It is disconcerting to know that the safety of the engine and the reliability of the supply depends on such an arrangement.

In other cases an electrically-driven pump is employed; if a duplicate pumping set is available, this arrangement is preferable to a pump driven from the engine, because in the latter case the engine may have to be shut down for hours due to a trifling defect in the pump, but even with duplicate electrically-driven pumps, a fuse may blow, and the plant may be disabled before the attendant notices that anything has gone wrong.

In a generating station containing 500 H.P. of Diesel engines, and 960 H.P. of gas engines, with which the writer is connected, both the above methods have been tried and found unsatisfactory, and when the plant was extended the following system was decided upon; it is not suggested that it is the one and only way to do the work, but it has worked well, and may be of interest to other engineers.

A pump room has been built at right angles to the engine room, and entirely open to it, so that everything is under the eye of the attendant. Above the pump room tanks have been erected at a sufficient height to supply water to all the engines by gravity; these tanks hold a supply sufficient for the whole of the engines for 20 minutes' running. The water flows from the various engine jackets, &c., into receivers arranged in the usual way, so that the flow in every water circuit may be seen without difficulty, and the temperature tested at intervals. These receivers connect to a hot water main, which takes the water by gravity to two of Heenan & Froude's rotary water coolers; the cooled water is discharged into an underground tank of large capacity, which is also fed by a ball valve from the town water supply. The floor of the pump room is sunk below the ground level to such a depth that all the circulating pumps are below the water level in the underground tank; this avoids the necessity for priming arrangements, and makes it certain that a spare pump can be set to work with the minimum of delay. Three motor-driven centrifugal pumps are installed in the pump room, two of which can deal with the whole supply; normally one pump runs continuously, the second is controlled by an automatic starter operated by a float, and the third is held in reserve. Duplicate electrical circuits are run direct from the main switchboard to the pump room.

It will be seen that the pumps deliver from the underground to the overhead tanks, and that the remainder of the water circuit is by gravity, and that, if the whole of the pumps are stopped for any reason, there is still 20 minutes' water supply for the engines contained in the overhead tanks.

This arrangement has important advantages, in addition to a reasonable certainty of supply. It enables the water to be turned on to an engine a few minutes before starting, thus making certain that the jackets are full and everything is in order, and it also allows the water to be left running after stopping the engine; if this is not done, there is no doubt that the cylinder jackets attain a very high temperature due to the heat stored in the cylinder walls, &c.; in fact, the comparatively small amount of water left in the water spaces quickly reaches boiling point unless the water circulation is maintained, and when the water attains a high temperature it deposits any scale-forming impurities which it may contain; this scale is most difficult to deal with, and causes troubles which will be referred to later.

There is an additional reason for maintaining the flow of water for some time after the engine is stopped. As soon as the engine is at rest the cylinder lubrication ceases, and the cylinder is left with a thin film of oil on its surface; unless the temperature of the metal on which this oil is lying is reduced quickly, it seems reasonable to expect that this thin film of oil will evaporate and leave the cylinder in a dry condition for the next time the engine is started.

Some engineers encourage the practice of leaving the cylinders hot in the case of gas engines, to prevent the deposit of moisture on the sparking plugs, but no difficulty has been found in this particular installation, possibly because Lodge ignition is used.

In addition to an ample and reliable supply of water, the quality of the water is of great importance. A very large number of cases of cracked cylinders, pistons, &c., on internal-combustion engines have been due to no other cause than the use of unsuitable water.

The water spaces in cylinder jackets, and particularly in cylinder covers, are generally intricate, and it is nearly impossible to clean them; if a bad water is used a scale will be deposited in these water spaces which will prevent the passage of heat from the interior of the cylinder to the cooling water, and the result will be the same as a failure of the water supply, that is, seized pistons, cracked pistons, cracked cylinder covers, burned exhaust valves, &c. Within the last year there have been many cases of failure in widely different localities due to deposit of scale; in some cases practically the whole of the water space has been filled up, leaving only a small channel through which the water flowed, of course doing practically nothing towards cooling the cylinder or cover.

The same effect has been brought about by drawing water from a stream which carries down mud in wet weather, the mud filling up the water spaces very rapidly.

To avoid these troubles it seems advisable to use the best water available, and to use a sufficient quantity to keep the temperature down to such a low figure that there is little risk of deposit. When it is considered that the cost of replacing a cylinder cover or piston may amount to as much as £60, it is obvious that the use of anything but the best water available should not be considered. It has been proved many times that a water which is good enough for boilers is frequently not good enough for internal-combustion engines because of the difficulty of removing deposit.

The cooling of the water is a matter of considerable importance.

The makers of internal-combustion engines generally state the quantity of cooling water required, and they usually

assume a temperature of 60° F. Now, in all except the smallest installations, the water must be cooled in some form of cooler, and if this is done the temperature of the cooled water will be at times as high as 80° to 90°. The temperature at which the water leaves the engine is limited to a certain maximum figure, partly because of the necessity of keeping the cylinder temperature down, and partly to avoid scale; this figure may be taken at about 120°—130°; it is possible to go higher with safety if it is necessary, but it does not appear to be advisable to do so.

If, therefore, the maker of the engines specifies a quantity of water on a temperature range of 60°—120°, and owing to any reason the temperature range at certain times can only be 90°—120°, then approximately twice the quantity of water must be used and the water plant must be designed accordingly.

It is also important to see that the water does not become concentrated. The evaporation at the cooler is taking away a proportion of the water all the time and leaving the solids in solution in the remainder; consequently, a water which at the start was good will in time become unsuitable, and require renewing; in districts where the air is clean the drainage of the roofs may be led into the water tanks, so that in rainy weather they may be flushed out with soft water, and the water renewed without expense.

A consideration of the points mentioned in this article will show that, although there is no difficulty in providing an efficient supply of water for internal-combustion engines, the details require careful consideration, and the matter is of some importance, because on details of this description the success of an installation largely depends.

ELECTRIC INCUBATION.

The electricity supply companies of America are nothing if not practical. They believe that in order to promote the sale of electricity it is necessary to inspire a customer with a reason for the faith that is in him with regard to the advantages of electricity applied to the everyday needs of the community. As a large proportion of the customers of electric light and power companies throughout America are situated in rural districts, the attention both of electrical apparatus manufacturers and of electric supply companies has been directed very especially to the problems attending the application of electric power and heating to the needs of farm life. Bearing this point in mind, it is interesting to refer to a demonstration which has recently been given by the Kentucky Electric Co., of Louisville, for the purpose of demonstrating to the public generally the advantages of electric heating for incubators. In order to effect this, a show window was set apart for the demonstration, and it naturally attracted a very considerable degree of attention, as it was situated in a position easily available to the general public. A "Cyphers" electric incubator with a capacity of 120 eggs was used. The incubator was set on February 27th, with its full complement of eggs, and on the seventh day of incubation the first test was made and 11 imperfect eggs were discarded. The demonstrations were carried out by Mr. Eugene Strauss, proprietor of a well-known American poultry farm, and white Wyandotte eggs were used. Mr. Strauss devised a rather ingenious appliance, by means of which he obtained satisfactory tests on the eggs with the results indicated. Three of the 11 eggs displayed dead germs, while the remainder showed up as unfertile eggs.

The second test was made on the 12th day of incubation, when again 11 eggs were discarded. The test revealed that each egg contained a dead embryo, showing that the eggs in this case were originally fertile. It was easy to find an explanation for this catastrophe, however, as a section of the incubator was for a few hours on the preceding day subjected to the direct rays of the sun through a heavy plate glass window. As a result of this increased temperature, the 11 eggs were literally cooked. This left 98 eggs in the incubator at the hatching period, which began on the 20th day.

A rather remarkable record of 86 chickens emerged from the shells during the two days of the period. Unfortunately this success in itself proved the cause of another disaster, as owing to a failure to relieve properly the congestion in the hatching drawer of the incubator, 21 of the chickens were smothered before they dropped into the warming chamber at the bottom of the incubator. This left 65 chicks, which were placed in the brooder and kept in the window for four or five days as an exhibit of the success of the undertaking. Only two chickens died in the brooding pen.

The temperature within the incubator was started at 101° F., and increased on the second day to 103°. The purpose was to keep the temperature as close as possible to the latter figure, and only for a few hours did it vary from this point. The minimum was 101½°, and the maximum 105° in these fluctuations. The hygrometer varied during the period of incubation from 52 to 67, and the outside temperature ranged from 56° to 74°. The total energy consumption of the whole period was 14 KW.-hours. From an advertising standpoint, the demonstration proved to be a great success. The results were shown day by day on a blackboard giving the temperature readings and the amount of energy consumed. When the chicks began to pick the shells, interest increased until there were hundreds of persons around the window for hours at a time. It is on this account that we hesitate to recommend the same demonstration to British electricity supply companies, at any rate in the more congested thoroughfares of our cities, as we do not wish to incite our readers to perpetrate any acts which may lead them into collision with the police. Nevertheless, the value of ocular demonstration of this description is undoubted, and at the present time, when poultry farming appears in many quarters to be receiving new and scientific attention, it might be advisable for electricity supply companies to make a feature of this in order to draw attention to some of the useful applications of electricity supply on the farm and homestead.

WORKING UNDER A NON-TECHNICAL GENERAL MANAGER.

By AXON.

In many businesses of a purely engineering character, or of a nature which makes them dependent for successful working on the proper and efficient management of an engineering plant, it is often found that the general manager at the head of the whole concern is a purely commercial man, having no knowledge whatever of engineering matters save that which he has picked up in the course of every day contact with the members of his staff who are responsible for the engineering department, or, in the case of a manufacturing firm, the men who actually design and superintend the manufacture of the firm's products.

Now seeing that the business could not go on without the help of skilful designers and superintendents, and that it is an engineering business when all is said and done, it may appear terribly unjust to the engineering staff that they are under the direction of a commercial man without any engineering training, and that the salary of this commercial man should be much greater than their own. Especially does this feeling become keen when the engineers reflect that the training of the general manager has not cost him in either time or money, study or worry, one half the expenditure and self-denial that the engineer's training has cost him. No engineer to-day can be said to have even a chance of competing for the higher appointments in the profession unless he has an education which will take him more than half way towards a B.Sc. degree, in addition to a long and fairly wide practical experience. It is the above feeling of injustice which is the cause of the want of co-operation so often found in engineering works which are controlled by a commercial man as general manager. This want of co-opera-

tion is altogether wrong, both as regards the welfare of the engineering staff and also in the light of their clearly defined duty towards the firm which employs them.

The sole reason why any person risks capital in establishing a business is that he hopes for a good return on his money; therefore the real object of the business is to make money. This fact is so very often forgotten by engineers when placed at the head of a business and allowed to control its destinies, that investors and boards of directors have by painful experience learnt that a first class engineer is necessary, but also that in the majority of cases, especially if the engineer is also an inventive genius, it is absolutely necessary to have a commercial man to direct the general policy of the concern if it is to remain a paying business. In many cases where this arrangement is in force there is a studied hostility on the part of the engineering staff towards their commercial colleagues, this being rendered possible by the fact that the directors or committee wisely insist that the engaging or dismissal of any member of the engineering staff shall be left absolutely with the chief of the engineering department. From some experiences which the writer has recently undergone, he is convinced that this attitude is not only wrong on the grounds of interfering with the career of the firm or department, but that it is also very wrong in regard to the best interests of the engineering staff.

In a case in which the writer has been recently a spectator from the inside, the policy of the head of the engineering department was to keep the general manager as much as possible in the dark with regard to every detail of the engineering side; the general manager did not take the matter up with the directors simply because he did not intend to acknowledge that he felt for the time being inconvenienced, and the engineering department almost to a man thought that this state of things could be always maintained, forgetting that the general manager had been previously manager of a similar business, and was by no means wanting in resource, brain power, or determination. What happened might easily have been foreseen, and was in fact pointed out by the writer as the line which the manager would take. After taking a month or two to attend to matters which were ready to his hand and which were of a purely commercial nature, the manager suddenly surprised everyone by stopping the manufacture of a certain article which he said did not pay. The chief of the engineering staff tried in vain to refute this idea; there were the figures in black and white to prove the matter, which figures the manager showed could have been obtained any time during the last couple of years by anyone having even a moderate amount of the commercial instinct. As the previous general manager had been an engineer, and as the board of directors had thought that a more commercial manager would be advisable when he left to go to a better appointment, this little matter was exceptionally nasty for the engineering staff to digest. The directors did not altogether like the stopping of this line as it was of old standing with the firm and somewhat a pet idea of the late manager's, but the figures were undeniable, and at the end of a further six months' working the accounts proved the absolute soundness of the manager's policy.

By this time the manager was able to progress a trifle faster and officially complained to the chief engineer that a certain department was costing a heavy sum to run. To this the engineer replied that the department could not be run for less, forgetting, as so many engineers in a similar position forget, that a man who has been managing a similar business elsewhere must have records and statistics of what was done and of how much it cost, or that if he has not the exact statistics for that particular job he will have friends in the old place and in similar businesses elsewhere who will help him out of the difficulty. At the end of another three months the manager again told the engineer that there had been no improvement and that he considered one easily possible; he was again met with the same answer from the chief engineer. The reply to this was very quiet, but extremely effective. The manager appointed an additional departmental head, placed him at the head of the disputed department, and removed the department from the control of the official who had previously managed it alone, with another department, giving as his reason for the appointment, the fact that the work of both departments had so much increased that this additional official was necessary. The chief engineer seeing that he was playing a losing game in this case did not fight the matter. The new official was brought from the works which the manager had previously controlled.

To cut a long story short, it will suffice to say that the new official put all he knew into the work of the department, and in six months reduced the cost of that department by 15 per cent. Instead of taking the lesson to heart, the chief engineer simply pursued his old policy of attempted concealment and evasion, and then woke up one fine morning to find that a project for very large extensions had been talked over between the board and the manager, and that an outside engineer had been called in to advise on the matter. The engineer then realised that only his long connection with the firm had saved him from being asked to resign some time previously, and seeing a chance of a move to another firm he took it, being helped into it by the manager whom he had tried to trip up.

What then, it may be asked, is the correct policy for an engineer to adopt who is under a commercial man? The only policy is that of absolute straightforwardness; and this policy is not only ethically right, but it also produces the best working results for the engineer and the whole of his staff. The idea of an engineer so placed should be to implant the firm conviction in the mind of the manager that he has only to turn to the engineer in any of his difficulties in order to be helped out of them in the best possible manner, and with willingness and promptitude. Let the manager feel convinced that the engineering department is being carried on in a proper and trustworthy manner, and there will be no interference with matters which are in themselves purely engineering matters. The majority of managers are only too glad to feel that this part of the business is in reliable hands, whilst in case the engineer has to complain of undue interference, the fact that he has always supplied all information asked for promptly and correctly, and that this information has been found to be sound, will put the engineer in a very strong position when he approaches the board.

The object of an engineer so placed should be to make the manager feel that he cannot afford to lose the services of his engineer, and that he is his right hand. The engineer should not wait for the manager to approach him previous to a discussion on the policy of the firm, but should make a point of regularly talking over matters with the manager, and suggesting improvements where he thinks they are necessary. This may seem a platitude, but the fact is that the writer knows more than one capable engineer who deliberately adopts the attitude of waiting for the manager to come to him seeking information, cap in hand, as if any man with a man's spirit would put up with so humiliating a position. One engineer personally known to the writer adopted this attitude for some years, and then expressed great surprise one day to find that the manager had gone elsewhere for his information, and that, as a consequence, the manufacture of a certain line of goods in his department was stopped and given to an outside firm, thus taking away from the engineer a large part of his responsibility, and the opportunity for further advancement.

Engineering is so fascinating a profession that, in spite of its poor pay and exacting demands in the way of study and time, many engineers would not care to leave it for a position in which the engineering side took a distinctly secondary place, and to such engineers the only policy which will bring progress, peace of mind, and respect, is the policy outlined above of serving the manager, and through him the firm, to the best of one's ability. Even with a manager who seeks to take all the credit to himself this is the only sound policy—to serve him well until one can get away.

An engineer who seeks a managerial position should first obtain a good engineering training, and then, after some short practical experience, get into the commercial side; he will then be so valuable a man after a few years spent commercially, that he is almost bound to obtain a position with comfortable hours and a first-class salary.

In conclusion, remember that people go into business to make money, not to carry out marvellous engineering feats which spend money and do not make it; and that, although

the engineering works could not be run without an engineer, yet the possession of commercial acumen and skill is absolutely necessary if money is not to be lost, and that if the shareholders could not get an engineer to run their works, and had, therefore, to give up the idea of engineering, the skilful commercial man could still get them 4 per cent. or 5 per cent. on their money fairly safely, without the risks run in manufacturing. And it is money that shareholders are after.

THE CARELS-DIESEL ENGINE WORKS.

Last week, on the invitation of The Consolidated Diesel Engine Manufacturers, Ltd., we paid a visit to the works of the well-known firm of Messrs. Carels Frères, at Ghent, who are associated in the above-named concern with the Diesel Engine Co., Ltd. The Consolidated Co. is building a new works at Ipswich, which will be put in operation in two or three months, and as, we believe, by far the greater part of the output of Carels-Diesel engines is already disposed of in this country, it is clear that the works will start with an assured market for its products.

The firm of Carels long ago acquired a world-wide reputation for the manufacture of the steam locomotive, and later of the stationary steam engine; but its attention was early attracted to the principles put forward by Dr. Diesel, and 20 years ago it obtained the right to manufacture under his patents.

But the evolution of the Diesel engine was not a matter of months; not until 1900 was its development so far advanced that the regular manufacture of the engine on a commercial basis could be commenced. Since that year constant progress has been made, the engine being built in continually larger sizes, and during the past five years Messrs. Carels Frères have been building reversible engines for the propulsion of ships, in addition to the types they had been constructing for driving dynamos and workshops. Three years ago they proved their ability to obtain 1,000 B.H.P. from a single-cylinder engine, and their successes speedily rendered it necessary to extend their own works, doubling their power of production, and to grant manufacturing licences to a number of foreign firms, mostly in this country.

The Carels-Diesel engine for land installations is usually built on the four-cycle principle, with vertical cylinders; the two-cycle design is adopted for powers above 700 H.P., while small engines are made of the horizontal type. One of the most notable achievements of the firm was the development of a successful system of reversing gear, in 1908, rendering the engine suitable for the propulsion of ships; a four-cylinder reversible engine of 1,000 B.H.P. was completed in that year, and was followed two years later by the development of 1,000 B.H.P. in a single cylinder, forming part of a six-cylinder reversible 6,000-B.H.P. engine. The principal feature of the firm's large exhibit at the Ghent Exhibition this year is a very fine six-cylinder engine of this type, built to the order of the British Admiralty, and developing 2,200 I.H.P. This engine, with the propeller revolving in air, was repeatedly reversed in our presence from full speed ahead to full speed astern, and *vice versâ*, the operation of reversal being completed in less than seven seconds.

The manufacture of the Diesel engine is not a task to be lightly undertaken. An exceptionally high degree of accuracy in workmanship is indispensable, and there are many special problems to be solved which are not met with in ordinary engine building. A knowledge of the proper qualities of castings to be employed is essential, and long experience is necessary to ensure successful results. All these requirements are fulfilled in the works of Messrs. Carels Frères, who have made a special study of the subject for 20 years, and stand in the foremost rank of Diesel engine builders.

The works at Ghent are largely of modern construction, and are well laid out for the economical manufacture of the engines; they are provided with an ample equipment of modern machine tools, derived from various countries, the principle followed being that only the best should be installed, no matter whence obtained. The foundry is an exceptionally important department in this branch of engineering, the castings being much more complicated than in steam engine practice, and Messrs. Carels Frères accordingly have devoted a large space to this purpose; their special facilities enable them to make very big castings for other purposes, one shop being set apart for the casting of enormous flywheels, of which a large number were in progress at the time of our visit.

An elaborate and highly organised system of passing orders through the shops has recently been introduced, and is in course of development with a view to ensuring that, as far as possible, every man and every machine shall be kept employed in the most economical and efficient manner; the manager is enabled to see at a glance the position of every job, what machines are available, and whether time is being gained or lost on the estimated time allowed for the completion of each stage. The scheme is worked in conjunction with a bonus system, and a cardinal principle of the method is to see that at least two days' work is always planned ahead for every man or machine, so that the foremen are relieved of the necessity of allocating jobs and can devote their whole attention to the maintenance of high quality of workmanship. Special attention is given to the physical welfare of the workmen, ample facilities for washing and feeding being provided; cooks and cooking apparatus are supplied at the firm's cost, and the commissariat is managed by a committee of the men, to enable them to obtain meals at the minimum cost. Moreover, the large messroom which is now being completed will be furnished with periodicals, &c., and will be kept open to a late hour in the evening, in order that the men may use it as a recreation room. The physical and psychological needs and propensities of the men are far too seldom adequately cared for, and in this respect, as in others, the example set by Messrs. Carels is worthy of imitation.

It is hardly necessary to add that the new works at Ipswich will have the benefit of Messrs. Carels' experience and skill, and will thus be enabled to start right away under the most favourable conditions. At a later date we shall have an opportunity of placing particulars of the works before our readers; for the moment we conclude by expressing our appreciation of the enterprise of the Diesel Engine Co. and Messrs. Carels Frères in embarking upon the manufacture of their engine in this country, and our hope that they will never have occasion to regret that step.

PLANT EXTENSIONS AT BRADFORD.

In a lengthy report to his committee, Mr. Thomas Roles, the city electrical engineer, discusses the future of the Corporation's generating station in Valley Road.

The present capacity of these works is 15,800 KW., but this includes 2,800 KW. in 12 direct-current high-speed engine sets in the No. 2 works, which would ere this have been disposed of, had not recent winter loads compelled their retention. Generally, he considers that in future extensions on this site three-phase turbo-generating plant should be adopted and installed in the No. 3 works, the No. 2 works being retained as a town sub-station, and equipped with the necessary transforming and converting machinery for supplying the direct-current lighting and tramway networks.

His immediate recommendations, then, to provide for the winter of 1914-15, are that a 3,000-KW. turbo-alternator be installed to replace the obsolete high-speed engine plant in the No. 2 works, where two 1,500-KW. rotary converters will be installed; in place of a third similar stand-by plant, Mr. Roles proposes to provide a battery capable of discharging at the rate of 2,000 KW. for one hour. Various other additions are outlined, including induced-draught plant, suction ash-handling plant, cooling towers, &c., and the scheme is estimated to cost in all £86,250, which expenditure has been approved by the Corporation Finance and General Purposes Committee.

Probably the most interesting part of this report deals with the distant future of the Valley Road works. Mr.

Roles, looking some ten years ahead, comes to the conclusion that while the position of these works will always be an excellent one as a direct-current distributing centre for the city, yet, with the increase of load and the necessity of installing still larger sets than those at present contemplated, as well as the lack of adequate condensing water, and of land to accommodate any very large extensions to plant, it will be necessary to equip an entirely new generating station on a new site possessing adequate facilities for both coal and water supply.

This drastic proposal would, if accepted, involve the ultimate shutting down of the comparatively modern No. 3 station, and its use for some other purpose if necessary; but prior to this development, it is suggested that one, or perhaps two, of the 1,000-KW. low-speed engine sets shall be replaced by one or more turbo-generators, each of a capacity of 6,000 or 10,000 KW. capacity—the No. 3 engine room being capable of housing as much turbine plant as the boilers and cooling towers which can be accommodated on the site can deal with.

The report which we have outlined carries us very much into the future—in fact, to a time when, in all probability, the economic limits of individual generating station capacity will have been definitely settled; and this brings us to the question, which has, no doubt, received serious consideration by Mr. Roles—whether, after all, the future saving in cost with a brand-new power station will be such as to outweigh the undoubted additional security which would result from retaining the existing turbine station when the full complement of, say, up to 30,000 KW. of plant is installed, and building a new station to carry the additional load.

This question has been discussed by prominent American authorities, who have apparently decided against putting all one's eggs into the same basket, largely in view of the increased security of operation which is possible, and, one may add, imperative where local industry is dependent on the supply, but also because where stations of reasonable size are interlinked, efficient operation does not suffer to any extent.

No doubt, before the future Bradford scheme is carried into effect, intervening developments and experience will materially assist in solving the problems which are bound to arise in connection with it.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The British Engineering Position in China.

The keen interest you display in the furtherance of British engineering affairs is my excuse for seeking the hospitality of your columns to express my views on an undertaking which at the moment is being largely advertised. The British Engineers' Association has been called into being for the purpose of supplying—to use a homely phrase—a long-felt want. While the promoters do not altogether ignore the existence of a Government Department, presided over by an able officer in Peking, whose objects are presumably identical with their own, they make it pretty clear that they do not think much of its efficiency, and equally clear that they condemn the apathy and want of enterprise of the British manufacturing engineer; they are, they say, the people to make up for all shortcomings. There is a fine air of patriotism, too, about their pronouncements, a sort of "shoulder to shoulder" "Rule Britannia" sentiment, which appeals to audiences at friendly dinners and local gatherings, but does not "cut much ice" with the people amongst whom they intend to operate. While not doubting the sincerity of the Association's belief in itself and its objects, one is tempted to ask why they do not begin at home, where engineering manufacturers are driven frantic by foreign competition, and compelled to witness the spectacle every day of both public bodies and private firms placing orders for machinery with foreign countries, on terms which they cannot equal. Considerations of pocket easily override those of patriotism at home, and how does the Association propose by its intervention in China to bring about a different result?

Two principal factors influence the Chinese in placing machinery contracts, irrespective of the country of origin, or the nationality of the seller; first, the price to be paid; and, second, the length of credit to be obtained. Not Great Britain alone, but all the manufacturing nations on earth are here in the fiercest competition, and that country, Germany or another, offering the lowest prices, and the best terms, gets the business; the time is past when "British made" was a title to preference. Does the Association then, acting as *amicus curiæ* between its members and the Chinese, propose to induce these members, *i.e.*, manufacturing engineers, to reduce their prices to a competitive level, and loosen their purse strings? If they can do this they will have accomplished something practical, but much cannot be augured for their success. It is all very well to boast of a number of members whose capital aggregates £60,000,000; it would be much more to the point to know that even a trifling part of this enormous sum will be available for financing the contracts the Association hopes to influence in British favour.

Again, each member of the Association pays a sum of 10 guineas in consideration of a dozen enumerated privileges. It is my purpose for the moment to deal with only one, the first of these, which is stated to be worth all the money. Members are to receive reports at frequent intervals on matters which affect their business interests in China. I do not think the Association could even attempt to rival the Chinese in their methods of obtaining and circulating information. To be of any practical value, information as to a pending job or contract, must be instantly available, and not the subject of a general report, however frequent; that agent or representative would be but poorly equipped for his business, who was compelled to wait on these, and, moreover, the contracting and merchant firms with whom he deals, and who, by the way, must remain outside the fold of the Association, are splendidly served in this way.

I now come to the condition of affairs on the spot, and how these are likely to be affected by the activities of the Association, which starts its career with the avowed intention of fighting German predominance and counteracting German influence. The makers of machinery at home, those presumably who expect to benefit by their membership, have hitherto steadily declined to act as main contractors, for reasons of policy, the principal of which undoubtedly was that they would be called upon to abandon the sweet simplicity of "Cash against documents," for the risk involved in giving credit in a distant country. This means, as any thoughtful man familiar with the situation can see at a glance, that their agents or representatives are cut off from direct negotiation with the Chinese, by the fear of prejudicing or offending the merchant and contracting houses who are their principal, if not their sole, customers. It is only fair to make honourable mention, in passing, of one British firm—the General Electric Co., of China, of which the General Electric Co., Ltd., Witton, is the parent concern—who, under able management here and strong backing from home, have successfully established themselves as main contractors; their name does not appear as members of the Association.

And now comes the crux of the position; the contracting houses are nearly all German—such as the representatives of the A.E.G., Berlin, and the allied Siemens concerns, who, with their splendid organisation, tireless energy in travelling, lavish expenditure, and liberal terms to the point of rashness, have practically obtained possession of the field. Certainly 75 per cent. of the contracts made fall into their hands. Fortunately for the British manufacturer, this is where his representative comes in, and, owing largely to his efforts and the close and friendly relations he maintains with the German firms, British machinery largely preponderates as prime mover. His success in this direction is now likely to be most seriously threatened. How does the Association's commissioner propose to deal with this, in the face of the bold challenge thrown down to Germany?

The facts must be confronted; if he is out for a fight

let him look to it that he is prepared for the consequences, the first of which will be retaliation and the loss of our present principal customers. The issue is clear: either British merchants and engineers must combine both in brains and money to push the business along the lines so wisely and successfully pursued by their rivals, to a point even beyond that which they have reached, or better the British Engineers' Association had never been born.

An Old China Hand.

Shanghai, *July 11th*, 1913.

Air Filtration, Cooling and Ventilation of Electrical Machinery.

In view of the interesting paper on the above subject read by Mr. J. Christie, of Brighton, at the I.M.E.A. Convention of 1913, I wish to state the experience of the manufacturers of dry-air filters whom I represent in this country. Our experience extends over the whole period since turbo-generators were first provided with air filters, and we have several thousands of dry-air filters of different types now in use in practically every climate.

As manufacturers we turn out what is required, and if time should prove that the wet-air filter will do continuously what it has done at Brighton since last year, we should immediately manufacture this type.

Two instances may here be cited which cause us to hesitate. First:—The United States of America, the home of the wet-air filter, seem to be wavering in allegiance, as American orders have been placed for dry-air filters.

Secondly, the largest European constructors of turbo-generators are not favourably inclined to wet-air filters, although not themselves interested in the matter, apart from the effect on their machinery.

Taking seriatim the advantages claimed for the water-screen filter over the dry air or cloth filter by Mr. Christie, our past experience is as follows:—

1. The air must pass through a wet-air filter at slow speed if the apparatus is to work satisfactorily.

Judging from the illustration published on page 1088 of the Electrical Review, of June 27th, 1913, which is all I have in front of me, the wet filter takes hardly less floor space than a single-pocket cloth filter.

The size of a wet filter will always be in proportion to the quantity of air required by the generators, and will mean a proportion between the size of the air filter and the quantity of air to be provided, the speed remaining constant. Thus, a wet filter for dealing with 10 cb. ft. of dusty air per second will take double the floor space wanted for a filter of this type to deal with 5 cb. ft. The same applies to cloth filters.

We cannot, therefore, see why the size of a wet filter should increase in a lesser proportion than that of a cloth filter.

2. With regard to the risk of fire, I have before me data referring to about 3,000 or 4,000 generators provided with cloth filters. We have heard of three fires where the cause of fire has not been ascertained, so that cloth filters need not necessarily be responsible. The filters were in these instances not impregnated against fire; we now impregnate the whole of our filters to make them flame proof.

We further deliver, when required, our automatic system of shutters. These act at the least danger of fire and cut out the filter, while opening simultaneously another air duct, thus admitting air to the machine without the use of the filter.

3, 4 and 5: Without going closely into the question of the cost of maintenance of wet filters, about which we have no details, we know from our experience in other branches of our industry that the nozzles easily and frequently choke, and that for their cleaning complicated automatic appliances have to be used to prevent this. Without such appliances, sooner or later there must be a stoppage. The circulating pump and its motor require constant attendance, and the same remark applies to the renewal of the water. The least defect of the pump, the bearings, the nozzles, &c., means a complete stoppage.

A single-pocket cloth filter normally works six to eight weeks without any attention; then the pockets can be renewed and cleaned in one day, or even in a few hours, by employing sufficient labour. A stoppage at the period mentioned will not matter, because other parts of the generator will then also require inspection.

As a rule, spare cloths are supplied with our filters, and are used to replace the cloths while they are being cleaned.

By using the best cotton cloth obtainable, we have found that the cloths do not wear out quickly. We have filters in use which have been working for over 10 years; many have been working for five years, and in all these cases the cloths have not yet had to be renewed.

The expenditure stated to be £75 to £100 per annum for cleaning and upkeep of a cloth filter for a 3,000-kw. turbo-generator does not tally with our experience. I notice that Mr. D. Bennett states the cost of cleaning to be about £8 per annum. The figures we should give would err on the right side and would be eight cleanings per year by two men, taking each time two days. We should estimate the cleaning to cost £2 each time, or £16 per annum. Add to this the wear and tear of the cloths and take instead of 10 years a period of only two years; the cloths for this plant, which on the single-pocket system cost about £20, would mean £10 per annum, or £26 as the total cost of cleaning and upkeep.

In practice this is quite an outside figure. The cleaning does not require to be done so often, and can be finished by skilled men working at top speed in a few hours.

The water screen filter installed by Mr. Christie takes about 2 h.p., and a unit of this size generally requires about 15,000 cb. ft. of air per minute.

A single-pocket cloth filter, when thoroughly soiled, and then showing a resistance of ½-in. water column, takes for this unit 0·6 h.p.

6. The well-known construction of the single-pocket air filter prevents the choking of the pockets, which certainly was troublesome when a single cloth filter was used.

H. R. Witting.

London, W., *July 22nd*, 1913.

The Mutual Protection of Engineers.

The writer is pleased to see from your columns that there are others besides himself who object to the present methods of advertising vacant posts. Some years ago I had the painful occupation of replying to a number of advertisements in the Review, and out of over 30 applications had four replies, three of which were from firms who had given their names instead of a box number. If the proposed Association did nothing else than alter this method of advertising, I should think that it had been of use. I may say that I intend to join, although I am employed by a firm second to none in their treatment of staff men, and while I have no fault to find with my present position, I remember that I may not always hold it, and also that there are others who are worse off than myself. So far as I can see the existing Associations of various kinds do not meet the situation, and therefore I beg to sign myself

Prospective Member.

Slag Action in Electric Steel Refining Furnaces.

In your account of my recent informal talk before the Faraday Society on a new type of furnace, reported in your issue of July 11th, page 79, you state: "It is, however, a little difficult to understand how 'chemical' impurities are going to be removed by slag-action, seeing that the heating takes place from below the slag, and that the latter will always be at a lower temperature than the steel."

This is a point which has been frequently raised by the advocates of arc furnaces, in which the slag necessarily has a higher temperature because it receives the heat from the arcs and transmits it down into the metal. They have made a virtue of that which necessarily exists. I think it will not be denied, however, that the only chemical action which exists between the slag and the steel is along their surface of contact. The really active layers of slag and steel between which there can be any action, are, therefore, only of molecular thickness, hence almost infinitely thin. It seems unreasonable to suppose that there can exist any great

differences of temperature between these two thin layers, especially as the slag presumably "wets" the surface of the iron, if such a term may be used; between two substances which are in such close contact that one "wets" the other, there cannot, in my opinion, be any great differences of temperature, for, if there were, it would flow very quickly from one to the other until both were practically at the same temperature, or at least very nearly so. Hence even if the top layers of the blanket of slag were at a higher temperature than the metal, it is difficult to understand how that could materially affect that thin layer of slag which is in direct contact with the metal, and it seems to me that it is only that contact layer which can be chemically active.

Hence whether the heat flows from a hotter slag down into the metal, or from a hotter metal up into the slag, it cannot, it seems to me, make any material difference at the active surface of contact. While, of course, there would necessarily be a slight difference of temperature between the two molecular layers at their surface of contact, for the fact that heat is flowing from one to the other means that a difference of temperature must exist—yet it is difficult to see how that can be more than a very small amount, hence it cannot make much difference.

The facts concerning the furnace in question in which the heat flows from the metal to the slag, are that the sulphur is very easily eliminated; in one test, even under very unfavourable conditions, it was very quickly reduced from ·077 to ·006.

There may, of course, be some virtue in having an extremely hot slag, in that it is therefore more liquid, hence the exhausted molecular layers of contact with the iron are more easily replaced; but this may, perhaps, be accomplished more quickly by an active circulation, instead of by such extremely high temperatures as will injure the roof, and cause appreciable losses of heat through it.

In my opinion, a far more important feature than this possible slight difference of temperature between these two molecular contact layers, is a very rapid mechanical renewal of these contact layers, and rapidly bringing up every molecule of steel from the bottom of the bath to the blanket of slag, instead of waiting for the slow process of diffusion. It will, I think, be admitted by all those who saw the furnace in operation that there is no question that this repeated renewal of the surfaces of contact takes place very actively in this furnace. By continually and rapidly bringing fresh metal into contact with a fresh slag surface, it is reasonable to suppose that the rapidity of refining would be increased, and if this time of refining were thereby reduced to one-half or one-quarter, or even less, it would mean that the so-called radiation losses through the walls of the furnace would be reduced in the same proportion, and for refining furnaces in which there is no melting or increase of temperature, these wall losses constitute practically the total energy put into the furnace.

In a furnace with a very thick roof, which latter becomes possible when no electrodes have to pass through it, it is not unreasonable to suppose that the top of the slag will have nearly the same temperature as the metal below it, especially if there is a very active circulation. As long as the contact surfaces between slag and steel have practically the same temperature, and I hardly see how it can be otherwise in any furnace, it seems to me to be even an advantage not to have the slag excessively hot, for it would seem that the hotter it is the more it cuts the lining and the greater the losses of heat from the top. The cooler the top of the slag, the less will be the heat loss from the top and the less will be the destructive heat action on the roof.

Carl Hering.

Philadelphia, Pa, U.S.A.
July 22nd, 1913.

The 1914 Rubber Exhibition.—We have received a pamphlet giving particulars of the various competitions that are to be arranged on the occasion of the International Rubber and Allied Industries Exhibition in London next June and July. Copies can be obtained from the offices, 75, Chancery Lane, W.C. The purpose of the competitions is stated to be to encourage the better production of rubber, and suggestions by inventors and others of new uses thereof

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Large Impregnating Chamber.

The accompanying illustrations show a large impregnating chamber made by Messrs. Dryers, Ltd., 53, Victoria Buildings, Manchester, and installed at the Carville power station of the Newcastle Electric Supply Co. to the order, and under the instructions of Messrs. Merz & McLellan. The vacuum chamber is 13 ft. 6 in. in diameter inside, and is made to withstand a vacuum of 28 in.-29½ in., and a working pressure of 60 lb. per sq. in.

A removable varnish tank is provided to go on the platform car shown, for impregnation purposes. This tank is connected by a

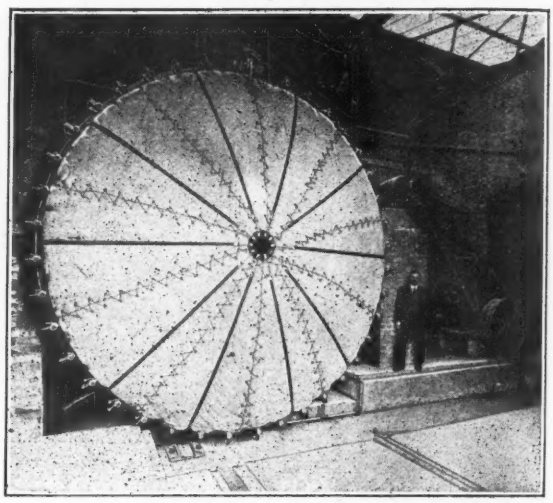


Fig. 1.—Impregnating Chamber, Closed.

swivel joint, shown in the interior view, fig. 2, to the varnish pipes outside, so that after being dried under vacuum the coils are flooded with insulating material and impregnated under pressure in the usual way.

The tank is large enough to accommodate a complete stator for a 10,000-kw. dynamo, weighing about 50 tons. The stator is placed in the tank when the latter is on the truck, and is then run into the

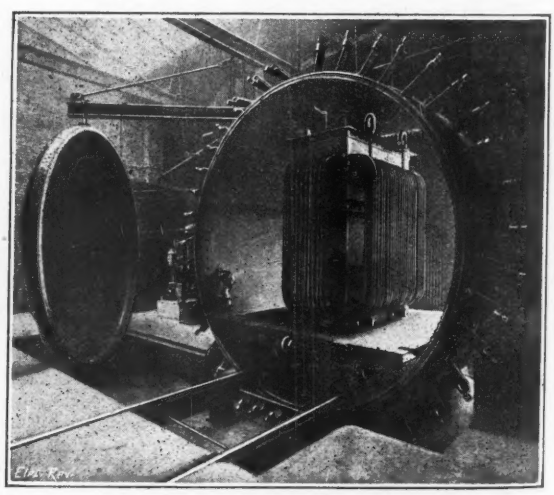


Fig. 2.—Transformer in Chamber.

vacuum chamber shown, dried thoroughly under a vacuum of about 29-29½ in., then flooded with insulating material, and a pressure formed inside, which forces the material all through and into every portion of the stator. The storage tanks for the insulating material are shown in the background, and are connected by means of overhead pipes to the tanks. All the connections are made at the top of these tanks to prevent any chance of leakage.

This plant is also used for drying transformers, and impregnating them with transformer oil. A special cooler for the air, which also acts as a condenser for any vapour which comes over, is installed close to the air compressor. A two-stage air compressor is provided for giving the necessary vacuum, and also for producing a pressure in the tank. There is also a special high-pressure boiler

which works at any pressure required up to about 250 lb. per sq. in., for supplying the necessary heat to the apparatus. The boiler was tested to 500 lb. pressure both before and after being installed. Electric temperature gauges for thermometers are installed so as to give the temperature at different points in the tank. There indicate on a board at the front of the engine room, on which a steam gauge, vacuum gauge, air-pressure gauge, and depth gauge for the insulating material are placed, so that all indications can be obtained at the same spot.

Conduit Spacing Saddles.

Messrs. Simplex Conduits, Ltd., of Birmingham, are introducing some new forms of "spacing saddles" for use where the conduit is installed on the surface, as in damp situations, &c. These are so constructed that the conduit is installed with a

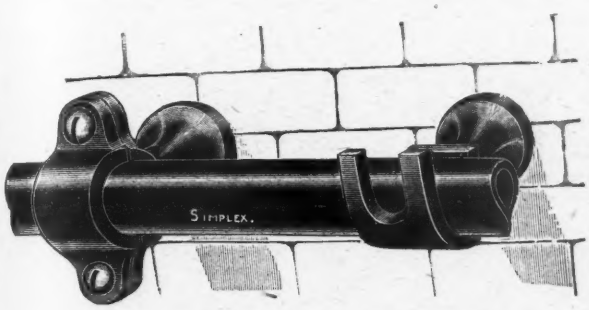


Fig. 3.—Two Simplex Spacing Saddles.

clearance from the wall, thereby guarding the conduit against the effect of surface moisture or sweating.

They are made in two forms; Type "A" is so constructed that the tube is simply dropped in position, the holdfast being made in two sizes, to take exactly the size of tube which is being used. Type "B" is an improved pattern, in which the conduit is firmly held, the fitting being made in two pieces, which are held together by means of two brass screws. The ordinary wood screws may be used, and considerable saving in labour is effected by screwing direct between the bricks, although the wall should preferably be first plugged. Both types are illustrated in fig. 3.

New Motor.

Messrs. Newtons, Ltd., of Taunton, inform us that they are placing on the market a commutating-pole motor of special construction. The magnet system, with the exception of the commutating poles, is of cast-iron and in one piece; the frame is ventilated so as to provide better ventilation in a vertical direction than hitherto. It is claimed that the use of cast-iron, combined with the particular position of the main field coils, gives a better torque curve in motors having series or compound field coils. Owing, too, to the poles being solid and of special shape, the machine is absolutely silent in running. A further claim is that the magnet system is the most economical at present known; the no-load losses are a minimum, and the efficiency curve is a particularly good one. In a 10-B.H.P. continuous rated motor running at 850 R.P.M., the constant losses at full load equal 550 watts, and the variable losses 700 watts, giving an overall efficiency of 85·4 per cent. at full load, 85 per cent. at three-quarter load and 83 per cent. at half load. The weight of these machines is about the same as that of the usual steel construction. A number of them have been supplied for quick-rated reversible lift motors, &c., as well as for continuous-rated machines.

The temperature rise is within the standard specified by the British Engineering Standards Committee.

A St. Helens Rubber Tire Exhibit.

Amongst the exhibits at the Commercial Motor Exhibition was one by the St. Helens Cable and Rubber Co., Warrington, of a new kind of solid rubber tire, which is worth mentioning in our columns, in view of its possible adoption on the electric battery vehicle, although, of course, it is suitable for use on any heavy motor vehicle.

The tire is of ordinary semi-circular section, and its special feature is the insertion between the hard tread rubber and steel band of a layer of specially pure, resilient Para rubber, which absorbs all road shocks, and relieves the tread rubber of their destructive effects.

The tire, which is known as the "Super-resilient" (Seymour patent) band tire, is the invention of Mr. E. Seymour, the St. Helens Co.'s works manager; it is claimed to have nearly 70 per cent. greater resilience than the ordinary solid tire.

The Lighting of Cinema House, Sheffield.

The lighting of this theatre is interesting, because it represents a harmonious combination of a number of different lighting systems. The installation scheme was prepared by the B.T.H. Co., of 77, Upper Thames Street, E.C., along lines suggested by Mr. Ravenscroft, the managing director of the theatre. The B.T.H. Co. also supplied the lamps, fittings and other lighting equipment.

The auditorium is lighted by B.T.H. trough reflectors, containing Mazdalite tubular lamps, concealed in the cornice. The light is projected on to the curved ceiling, and from there reflected downwards into the auditorium.

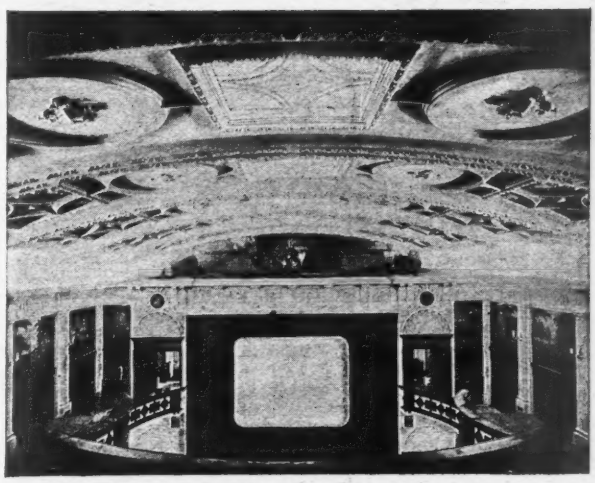


Fig. 4.—B.T.H. Lighting at Cinema House, Sheff

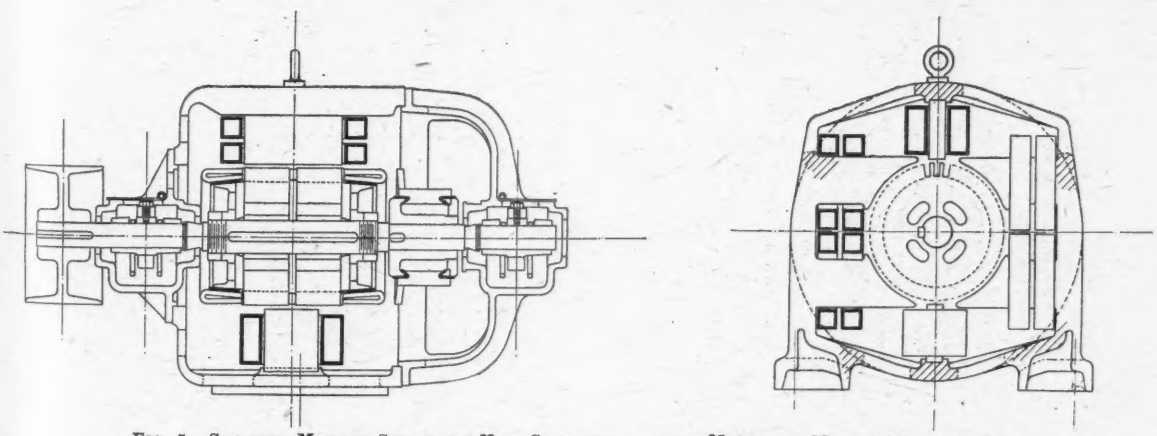


Fig. 5.—Showing Magnet System of New Commutating-pole Motor, by Messrs. Newtons, Ltd.

This cornice lighting is supplemented in a rather novel way. There are six domes in the roof of the auditorium, and each of these domes is covered on the under side by beautifully-tinted amber glass. Above the glass, around the bottom edge of each dome, is arranged a row of upturned Mazdalux reflectors, containing Mazda drawn-wire lamps, and the light is first projected on to the white dome, and then thrown downwards into the auditorium *viâ* the stained glass, giving, we understand, a delightful effect.

The foyer and entrance are illuminated by indirect and semi-indirect lighting fittings, while in the tea-room B.T.H. Holophane reflector bowls, supplemented by wall brackets, are used.

E

Some New Westinghouse Starters.

The British Westinghouse Co., of Trafford Park, Manchester, have recently introduced a new design of multiple-lever starter, which embodies many improvements on their older pattern.

We illustrate the new switch in fig. 6. It is a "loose handle" starting device, and the brushes open automatically should an overload or no-load occur at starting or subsequently, quite independently of the operating handles. Thus it is impossible to start up too rapidly; the levers can only be closed in correct sequence, and they come out in the opposite order, and are ready for starting up again without further adjustment.

The overload coil in operation opens the circuit of the no-volt coil, which method possesses a great advantage over the usual practice of shorting the no-volt coil, in that the overload attachment breaks the no-volt coil circuit under all circumstances. In starters where a short-circuiting device is employed, the contacts are liable to become oxidised when not used for a considerable time, causing them to fail to operate at the critical moment.

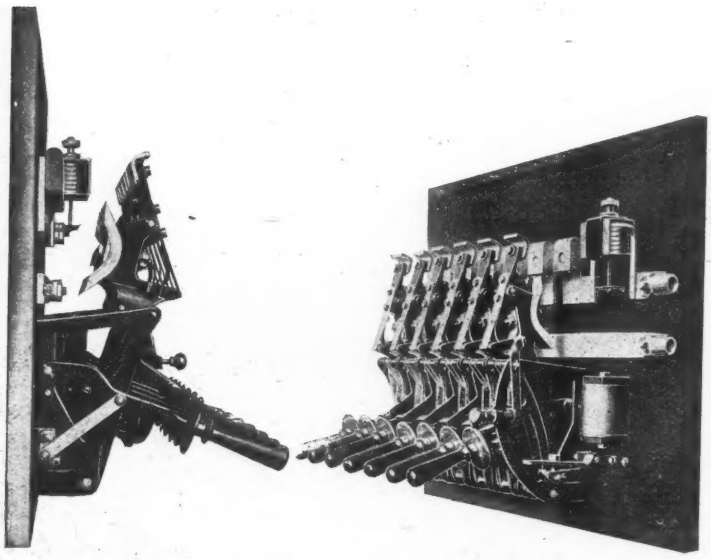


Fig. 6.—Views of New Westinghouse Multiple-Lever Starter.

Regulation over any number of steps can be obtained if desired, whilst all the automatic features can be retained. Thus, if it is desired to eliminate a separate rheostat for speed regulation, additional levers over and above those required for starting only can be fitted in order to obtain the necessary rheostatic effect.

The overload devices can be fitted to much larger sizes than hitherto, and can be fitted with time-limit devices if desired. A push-button trip is provided. Other features are laminated brushes with a large break, handle shields and grid-type resistances, mica insulated.

Fig. 7.—Westinghouse Star-Delta Starter.

This type of switch is particularly suited for the larger sizes of direct-current motors, where the usual radial switch starter cannot be employed.

The Westinghouse Co. have also introduced a new design of star-delta starter, embodying some interesting features, and designated type "O.R.S."

The internal parts are mounted in a cast-iron frame, with a cover having a suitable vent for gases. The oil tank is below, forming the lower half of the starter, and can easily be lowered away when necessary. The contact drum is made on the metal and mica principle, and consists of a mica-insulated square steel shaft, on which are securely clamped spider castings carrying renewable segmental copper contact strips, working with standard contact fingers.

The no-volt and overload releases are fitted in the starter above the oil tank. The no-volt coil is connected across one phase, and is so arranged that the circuit to the motor can only be closed when there is voltage on the line. This release is worked by gravity, and acts quite independently of the overload release.

The overload coil is connected in two phases, and is cut out in the star position, and can be set between approximately full-load and 100 per cent. overload.

The operating handle is of the "loose" crank handle type, and the mechanical operation from the off to the star position, and thence to the delta position, is so designed with interlocks that the starter can be operated in no other way. A device is fitted making a slight pause necessary at the star position before it is possible to move the handle through to the delta position. The handle cannot be left in the star position, since when it is released it flies back to the off. The contact drum is returned to the off position (thus stopping the motor) in the event of an overload or no-volt occurring.

Ammeters can be mounted on these starters when desired, the instruments being of the moving iron type, and are not in circuit when the drum is in the star position.

Trifurcating boxes can be fitted if required, in which case the starter fully conforms with the new mining rules.

A Safety Device for Lifts.

In view of the recent discussion in our pages on safety devices for lifts and elevators, a reference to a form of safety device which is extensively used in the United States may be not without interest. This is made by the Altizer Elevator Co., of Chicago, and consists briefly in a friction governor which is of very simple construction, and, at the same time, very substantial and effective in operation. There are four important features in this safety device, the first being that there is no limit to the power, as the car becomes its own power as soon as the governor is thrown into operation, and the vice-like jaws continue to pinch tighter, until the car stops. The action, which is produced by a screw and wedge working together, is very powerful, yet the motion is gradual, bringing the car to an easy stop without jar. The shaft on which the governor is mounted is self-adjusting, making the pressure equal on each end, and thereby holding the car perfectly level. Moreover, the releasing of the safety device after it has been thrown into operation, and is holding the car, can be easily accomplished without danger to the operator by first adjusting the lifting cables so as to hold the weight of the car, after which the governor is turned in the opposite direction to that in which it originally operated in setting the jaws, leaving the rope on sheave and clutch in until the wedges are in their proper place. The clutch is then released, and the car is again ready for service. This safety device is placed under the bottom of the car, and in view of the length of lift operated, and the high speeds which are sometimes attained by the cars, it is probable that the device has been sufficiently tested in American practice to warrant consideration.

PROCEEDINGS OF INSTITUTIONS.

A New Method of Cooling Gas Engines.

By Prof. Bertram Hopkinson, F.R.S.

(*Abstract of paper read before the* Institution of Mechanical Engineers, *July 29th*, 1913.)

External water-cooling is the ultimate cause of most of the disadvantages under which the gas engine has hitherto laboured and which have retarded its development in large sizes. The provision of a jacket, and of the elaborate appliances necessary for the circulation of water in the moving piston and exhaust valve, must be largely responsible for the great weight and cost of large engines of this type.

The inequalities of temperature set up in the metal cause stresses, which are very liable to crack a casting already (by reason of the double wall required to form the jacket) difficult enough to design and manufacture. Secondly, the overheating of certain parts of the inner surface, whose temperature is much above that of the water, is apt to cause pre-ignition of the charge, especially if deposits of carbon or tar are formed. In consequence of the dangers of overheating, it has been found impossible to work gas engines, especially of large size, continuously at the maximum power which they can develop. If it were possible, the cost per horse-power would be reduced by from 20 to 40 per cent.

If water can be injected internally against the sufaces to be cooled, the heat is removed on that side of the metal on which it is generated, and, therefore, there is no heat-flow through the metal, and no difference of temperature between the inner and outer surfaces. A simple single-walled casting can be used for the

cylinder, resulting in a great saving in weight and cost and in improved reliability on account of the elimination of casting stresses. The arrangements for cooling the piston, which are necessary in large engines, can be dispensed with—a point of great importance, because these arrangements, besides being costly, frequently give trouble, and their failure may easily result in wrecking the engine. Finally, pre-ignitions are entirely prevented.

In the method of internal injection described in this paper, cold water is injected through a hollow casting projecting into the combustion-chamber, and provided with a number of holes or small nozzles about $\frac{1}{32}$ in. in diameter. The jets so formed are comparatively coarse, so that even when projected into the flame the water reaches the part of the wall against which it is directed with but little evaporation on the way. The jets are directed to all parts of the surface of the combustion-chamber and against the face of the piston.

Most producer-gas contains a certain proportion of sulphur dioxide. This dissolves very readily in cold water, forming sulphurous acid, which rapidly corrodes any metal surface with which it may be in contact. Even when the gas does not contain sulphur dioxide, liquid water spoils the working of the engine by washing away the lubricant.

The author has overcome these difficulties by the simple device of regulating the amount of water injected in such a way that the temperature of the whole of the engine is kept well above 100° C. Under such conditions (which are only rendered possible by the absence of all external water-cooling) every drop of injected water is boiled when it reaches the walls, and no liquid can accumulate. That corrosion may be completely prevented in this way has been proved by actual trials.

The rate of heat-flow from the gas into the metal is far more rapid at, and soon after, the moment of ignition than at any other time. Hence it is sufficient to inject water on to the surface of the combustion-chamber and the head of the piston only, the whole of the cooling of the barrel being effected by conduction into the piston, which is itself kept cool by the projection of water on to the head when it is near the in-centre.

In order to put the author's ideas to a practical test, a Crossley gas engine, rated at 40 B.H.P., with coal-gas, at 180 R.P.M., was fitted with a new cylinder, consisting of a plain barrel without any water-jacket; no other change was made.

A section of the new cylinder is shown in fig. 1. The injection-rose is a hollow casting projecting into the combustion chamber. There are about 25 holes in the rose, each $\frac{1}{10}$ in. in diameter, and the jets proceeding from these are directed as shown against all

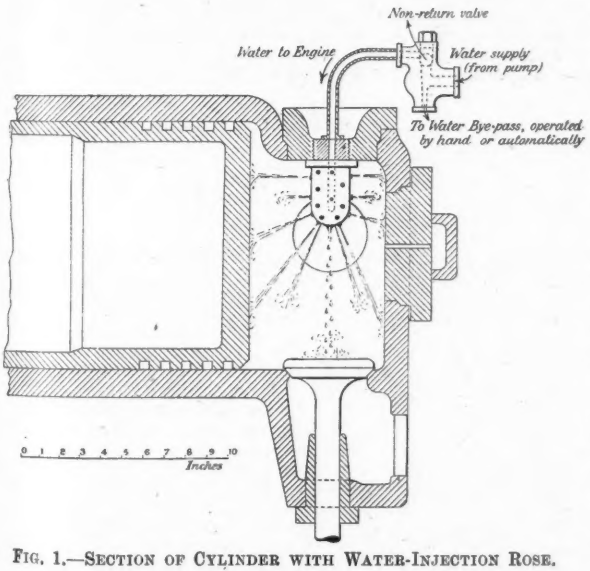

Non-return valve
Water to Engine
Water supply (from pump)
To Water Bye-pass, operated by hand or automatically
0 1 2 3 4 5 6 7 8 9 10
Inches

Fig. 1.—Section of Cylinder with Water-Injection Rose.

parts of the combustion chamber and piston-head. There is no jet on the exhaust valve, as it has been found that the drip from the rose is sufficient to keep this cool. The water is injected by a simple plunger pump, driven by a cam on the valve shaft, whereby a charge of water is injected once in a cycle. The pump stroke commences about 30° before, and finishes about 30° after, the point of ignition, so that water only goes in at a time when practically the whole of the sliding surface of the barrel is covered by the piston.

Immediately after erection with the new cylinder, the engine was run continuously for 120 hours on an electrical load, with coal-gas; it developed during this period 43 B.H.P. on the average, and ran very smoothly and steadily. The average mean effective pressure was 101 lb. per sq. in. When jacketed, the engine would not develop more than 40 B.H.P. continuously without overheating. The formation of the steam does not involve any thermodynamic loss, such as occurs when water is sprayed into the cylinder in an atomised condition and evaporated before reaching the walls, since the heat used is that which would otherwise be wasted in the jacket-water.

The quantity of water used on this trial was on the average 102 lb. per hour, equivalent to 2·4 lb. per B.H.P.-hour. The temperature of the engine varied from 150° to 180° C. When the engine was stopped at the end of the trial the inside of the combustion chamber was found to be perfectly dry.

The engine consumed in this trial 15 cb. ft. of Cambridge coal-gas per B.H.P.-hour reckoned at atmospheric temperature and pressure, approximately the same as it burnt when developing the same power for short periods when jacketed. On the average it may be said that the economy is unaffected by the use of this method of cooling; the reduction in maximum pressure is counter-balanced by a slightly raised expansion line.

After the trial just described, the engine was put to drive a dynamo in a factory engine room. Its speed was increased from 180 to 195 R.P.M. It was left in the hands of the ordinary engine room staff for several weeks, and was worked continuously for long periods of time at excessive loads. During this time it developed at times 50 B.H.P. with coal-gas for several hours together—an increase of 25 per cent. on the maximum continuous load which it could safely carry when jacketed. The engine is now at Cambridge in regular service with a suction-producer, driving the workshops and producing electric current for the engineering laboratory. It is left to itself like an ordinary gas engine, giving no trouble at all, and has now been in regular work for two years, the total time of running being 5,000 hours.

Anthracite coal is used in the producer, and this coal contains a considerable proportion of sulphur. Yet there has been no trace of corrosion in the engine. The combined wear (on cylinder and piston together) in the course of 4,000 hours has nowhere exceeded one-hundredth of an inch.

The ordinary working temperature of the cylinder is about 160° C., but the engine will run satisfactorily at any temperature between 120° C. and 200° C. Regulation of the water supply in accordance with the load is effected by coupling the pump to the hit-and-miss governor, so that the pump only makes a stroke when the engine takes gas. With a throttle governor it is easy to connect the gas supply and the water supply in such a way that the correct amount of water is delivered at all loads.

A simple form of thermostat has been designed, which opens a by-pass valve if the temperature falls too low; it has been in use for some months, and is quite satisfactory. Once adjusted, it need never be touched, and the engine can be started up in the morning day after day, and left to itself, no attention whatever being paid to the water supply. Failure of the water supply entails nothing worse than a temporary shut-down. The engine heats up quite slowly, and if unattended it stops by the occurrence of pre-ignitions arising usually from the injection-rose. Even in a 36-in. cylinder it has been found that no serious harm is done by such an event.

In order to guard against any danger, however, the engine is provided with a fusile plug, screwed into the wall of the combustion-chamber. Should the temperature rise above about 200° C. the plug melts, and the noise of the escaping gases warns the attendant. This simple device has been thoroughly tested and has been found absolutely reliable.

The method has been applied to the cooling of larger engines—one an engine of 18½ in. bore giving 105 B.H.P., the other a 1,000-H.P. Oechelhauser engine of 36 in. bore. In each case the water was simply run out of the jackets, the injection-rose fitted, and the engine put again to its ordinary work.

With no water in the jackets or pistons of the large engine, the temperature of every part of the engine when on full load could be kept between 100° and 200° C. The engine was taking full load within a few hours of fitting the apparatus, and ran for 30 hours without a stop.

The trials of this large engine, which continued for a considerable time, proved beyond any question that the largest cylinders now built can be cooled entirely by water-injection, if applied in accordance with the principles here enunciated.

The whole injection apparatus was made and put together in Cambridge; it cost about £20, and within a few hours of fitting it on the engine it was doing all the work of the complicated and costly plant—cooling tower, centrifugal pumps, 8-in. water mains, and the like—which is necessary for the cooling service of an engine of this size when jacketed.

The author put in hand an entirely new engine designed *ab initio* with a view to the use of water-injection, which is completed and is now undergoing trials. It is a two-cycle, single-acting engine, 18-in. diameter by 24-in. stroke, with separate gas and air pumps and is cooled entirely by water-injection.

Thunderstorms on the Rand.—In the eighth annual report of the Rand Water Board, the following paragraph appears respecting electrical disturbances:—"The policy adopted in previous years, of closing down the plant during thunderstorms so as to minimise damage by lightning, has been followed during the current season. The total number of stops due to electrical disturbances during the year ending March 31st, 1913, has been 53, and the time involved amounts, in the aggregate, to 123 hours. During the previous year, the plant was only closed down on 24 occasions, and the total stoppage was 61 hours 20 minutes. The comparison referred to above shows that the storms during the last 12 months were exceptionally severe. Storms have not only been numerous, but, in several instances, they have been of unusually long duration. Six of the stops, for instance, were for periods of over seven hours each. It is usually found that the potential is much higher in dry storms than in wet ones, and this is the reason why it has been necessary to close down a greater number of times during the recent drought."

LEGAL.

Tottenham Urban District Council *v.* Metropolitan Electric Tramways, Ltd.

On Thursday (July 24th) judgment was given in the House of Lords, allowing the appeal by the Urban District Council of Tottenham against an order of the Court of Appeal in favour of the respondents, the Metropolitan Electric Tramways, Ltd. The respondents were the owners and occupiers (*inter alia*) of lines of rails of certain tramways running through the streets of Tottenham. The question was whether that portion of the respondents' system, which had originally been constructed under powers given by the Tramway Act, 1870, was a "railway" within Sec. 211 of the Public Health Act, 1875. That section enacts that "land used solely as a railway constructed under any Act of Parliament" should pay rates on one-fourth only of the assessed value. In the present case, the company were for the year ending April 1st, 1910, assessed in respect of their tramway at £495 12s. 6d. They paid one-fourth, £123 18s. 5d., and refused to pay the balance. The action was then brought by the rating authority claiming the balance, £371 14s. 4d. The Court of Appeal, reversing the judgment of the Divisional Court, held that the company were entitled as a "railway" to the partial exemption given by the Act of 1875.

Mr. Macmorran, K.C., Mr. Ryde, K.C., and Mr. Cartwright Sharp appeared in support of the appeal; Mr. Danckwerts, K.C., and Mr. C. C. Hutchinson for the respondents.

The arguments were heard in June and judgment reserved.

Lord Moulton went exhaustively into the various statutes under which the respondents' system of trams was constructed, and into the authorities cited, and said that in the case of Swansea Improvement and Tramway Co. *v.* Swansea Urban Sanitary Authority, it was laid down in 1892 that a tramway laid in streets did not come within the exemption given to a railway by the Act of 1875. That decision remained unchallenged until it was overruled by the House of Lords in the Thornton case. In his opinion, that case and the Wakefield Corporation case in which the same was held, could be distinguished on the facts from the present case, and, therefore, the decision in the Swansea governed this, and the appeal must be allowed. When tramways were started, they were in the hands of private companies, and the Legislature was not disposed to treat them too liberally. On the other hand, under the Light Railways Act, 1886, the Legislature gave many advantages as inducements to promoters. It seemed to him that light railways, running as they did in many cases over land owned by the promoters, could get but very small advantage from municipal expenditure of the rates, such, for instance, as the lighting and sewering of roads, and therefore were justly entitled to contribute to the rates at one-fourth of their assessment. But that was not the case with a tramway running down the main streets, for the pavements might, in a sense, be said to be the platforms and stations for the use of their passengers, and they got full advantage of the lighting and general expenditure on the streets paid for by the rates. The undertakings sanctioned under the Light Railways Act of 1896 had secured irrevocably the Statute and privileges of light railways, however little they merited it. But the lines to which the present case related were constructed under the Tramway Acts, and, therefore, it was only indirectly that this House was concerned with what had been done under the Act of 1896. He thought that the distinction between a light railway and a tramway or tramroad was clearly understood, both by the popular and the legal acceptation of the two terms respectively; and that if the partial exemption to rates conferred on light railways by the Public Health Act, 1875, was intended to extend to "tramways," the Act would have made it clear in terms. Therefore, in public legislation the word railway did not include tramway, unless it was expressly made to do so by the terms of the Act. To hold otherwise would be to put trams under the exclusive jurisdiction of the Railway and Canal Commissioners, and it had never been suggested, during the 40 years of the existence of that Court, and would be obviously contrary to the intention of the Legislature, that that Court should control tramways. For these reasons the judgment of the Divisional Court should be restored, and the respondent tramway company must pay the appellants their costs in that House and in the Courts below. Order accordingly.

Solicitors: Mr. F. Shelton, for the appellants; Messrs. Ashurst, Morris, Crisp & Co., for the respondents.

Mygatt *v.* Glyn.

Mr. Justice Bankes, on Saturday, July 26th, delivered his reserved judgment in the action brought by Mr. Otis Angelo Mygatt, of Clifford Street, Bond Street, W., against Major Geoffrey Carr Glyn, Eaton Place, London, claiming £4,254 on a bill of exchange of April 12th, drawn by the plaintiff and accepted by the defendant, and payable on demand to the order of the plaintiff, and which plaintiff said, on being duly endorsed and presented by him, was disowned. The total claim, with interest, was for £4,660. The defendant denied that the bill was payable on account of certain arrangements that he claimed had been made, and he counterclaimed against the plaintiff upon an alleged agreement by which, he said, he was promised 10 per cent. of what the plaintiff received from the flotation of the English Holophone Co. and 10 per cent. of the plaintiff's income derived from all Holophane business.

Mr. Justice Bankes decided that the defence to the bill could not be sustained, and he gave judgment for Mr. Mygatt on this part of the case. As to Major Glyn's counterclaim for the two 10 per cents. and for 1,193 preference shares in the Holophane Co. transferred to him by Mr. Mygatt, he (the judge) came to the conclusion that Major Glyn had failed to establish any right to the payment of the 10 per cent. of the vendor's interest in the company, but he had succeeded in establishing his right to be paid for the relief services that he had performed between October, 1909, and November, 1910. As to the claim for 1,193 shares that it was said Mr. Mygatt should transfer to the defendant, he could not find that the defendant had proved to his satisfaction that Mr. Mygatt agreed to the transfer. He, therefore, entered judgment for Mr. Mygatt on the bill for £4,254 and interest at 6 per cent. from April, 1911, and costs; judgment for Major Glyn on the counterclaim for £2,000 and costs; and judgment for Mr. Mygatt on the issue as to the 1,193 shares with costs.

Glyn *v.* Mygatt.

Further litigation arising out of the business of the Holophane Co. was before Mr. Justice Bucknill in the King's Bench Division on Friday last, July 25th, when an action was brought by Major Geoffrey Carr Glyn, formerly managing director of the Holophane Co., against Mr. Otis Angelo Mygatt, to recover damages for alleged slander uttered on December 12th by the defendant of the plaintiff at a meeting of the directors of Holophane, Ltd., in regard to his position as managing director of the company. The case was heard on Wednesday, July 23rd, and Thursday, July 24th, the plaintiff giving evidence, and on Friday a settlement was announced.

Mr. McCall, K.C. (for Major Glyn), said that the parties had been able to act upon a suggestion by his Lordship that the case should be settled. He had agreed to accept on behalf of the plaintiff the defendant's withdrawal of the charges that he had made, and also to accept the statement that would be made on the defendant's behalf to the effect that in regard to the charge, having heard Major Glyn's evidence, the defendant was prepared to admit that Major Glyn had acted honestly and fairly, although, as they thought, mistakenly. The plaintiff (added Mr. McCall) had not brought the action to put money into his pocket, but merely for the purpose of vindicating his character as a gentleman engaged in commerce.

Mr. Justice Bucknill said that the invitation to settle the case had come from him. The correspondence showed that these two gentlemen, Major Glyn and Mr. Mygatt, were at one time on the most friendly terms, and when the defendant had heard what the plaintiff had to say, he thought he might venture to suggest the settlement. He was delighted at the result, and it was a result that was satisfactory to all parties.

The record was accordingly withdrawn.

BUSINESS NOTES.

Book Notices.—*The Newspaper.* By G. Binney Dibblee, M.A. London: Williams & Norgate. 1s. net.—This little book, though it contains a good deal of matter which is of interest to the vast army of men and women who gain their livelihood either entirely or in part in the multifarious occupations connected with the production and distribution of newspapers, no doubt has as its main object the informing of the mass of general readers who have their own quite different callings to follow. Even in these days, when it would seem that so much of honour and independence are sacrificed on the altar of commercialism, there is, we hope, still some interest surrounding those who mould—or should it be follow?—the opinion of the public, and we venture to believe that the man in the street, as we call him, is likely to have greater respect for the Press by reading what Mr. Dibblee has put together in this popular account of the newspaper, its function, its power as an organ of opinion, its news-collecting, reporting and business organisations, and its mechanical production and distribution. "Journalism and Journalists," the final chapter, contains some entertaining reading. For those who are in the thick of the newspaper fight, whether on dailies or on trade and technical organs, there are some comments in the chapter on "Business Organisation" which give food for thought; we refer especially to the author's reference to the necessity for resisting the "tendency to a decline and fall into the last stages of commercialism," and his comments on the "puff preparatory or supplementary"—a practice which, while not "in any way immoral," is undignified, and followed by "the weaker half of the Press of the United Kingdom." We are not sure that many of the items that are now circulated by advertisers for editorial use would not add to the interest of the circulator's ordinary advertisement. What is to be more desired, from the advertiser's point of view, than that the reader of a paper shall be got into the habit of regularly turning to see "what So-and-So have to say this week?" Mr. Dibblee has, in this book of 240 small pages, only touched the fringe of a subject which, if covered in detail, would require a work of many volumes He has, however, told sufficient herein to interest the ordinary reader and to indicate that he knows a vast deal more than he has written. He is quite accurate in his reference to the London electrical Press of to-day when he says that "the two earliest electrical papers are the Electrical Review

(1872) and the *Electrician* (1878)." We should hardly expect him to refer to papers born out of due time and now defunct, for he points out that, "confined as we are to a brief space, our best course is to deal only with living papers." The protest of a contemporary in this connection might be thought amusing enough for it to mark the occasion by awarding itself one of its own hot-plates.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 6. July, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"Collected Researches," Vols. IX and X, 1913, and "Report for the Year 1912" of the National Physical Laboratory. Teddington: The Laboratory.

"*Journal* of the Institution of Electrical Engineers." Vol. LI, No. 221. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for July, 1913, contains the following papers: "Phase Advancing," by Dr. G. Kapp; "Use of the Electrostatic Method for the Measurement of Power," by C. C. Paterson, E. H. Rayner and A. Kinnes; Report of the Council for 1912-13; Accounts for 1912; Application of Telephone Transmission Calculations," by A. J. Aldridge; "Use of the Thury System in Mines."

"Electricity for the Farm and Home," by Frank Koester. New York: Sturges & Walton Co. Price $1.00 net.

Patent Application.—THE BRITISH OXYGEN CO., LTD., have applied for restoration of patent No. 17,216 of 1909, for "Improvements relating to the liquefaction of air and the separation of it into its constituents," granted to Société l'Air Liquide.

The Black Gang in Turkey.—A British Consul at Constantinople, in a report published in the *Journal* of the British Chamber of Commerce of Turkey, refers to the activities of the Black Gang swindlers. We quote:—

"Notwithstanding all the warnings published in trade reports and Chamber of Commerce journals from Constantinople and Smyrna, the Black Gang has been more active and successful than ever in 1912.

"The following is a list of the Black Gang swindles which have been reported to this Consulate during 1912:—

"A Nottingham firm paid 50 per cent. (about £90) in advance on a consignment of 'scoured white wool,' which upon arrival turned out to be a mixture of cows' hair and lime of a totally different weight.

"A Dublin firm of candle manufacturers ordered 1½ tons of 'genuine beeswax,' and paid 80 per cent., or £140, in advance. The goods, on arrival, weighed only ¾ ton, and consisted of almost valueless 'off-colour' paraffin wax.

"Another Dublin firm lost £170 by precisely the same trick.

"A Birmingham firm paid cash against documents for 'a parcel of hair,' which upon arrival proved to be valueless matter of one-quarter of specified weight.

"Finding that the rubbish which it sent to Europe and America was not appreciated by the buyers, the gang has now gone one better, and has had false bills of lading printed, which it supplies to its clients. The same purpose is served, as the buyer advances his 80 per cent. just as readily on the forged bill of lading, and the gang is spared the expense and trouble of shipping the rubbish.

"The names under which the gang trades have been furnished to the Commercial Intelligence Branch of the Board of Trade, but there is no reason why they should not employ any name. The obvious precaution is to inquire from this Consulate, or from the British Chamber of Commerce, before dealing with strangers on this market."

The Holidays.—THE BRIMSDOWN LAMP WORKS will be closed from to-morrow (Saturday, August 2nd) to Monday, August 11th, for the annual holidays. The staff at the Kingsway offices will attend to urgent business and execute pressing orders.

THE UNION ELECTRIC CO., LTD., announce that their offices and stores will be closed on Monday and Tuesday next, August 4th and 5th, and the works from Monday, 4th inst., until Saturday, the 9th inst.

THE ELECTRICAL POWER STORAGE CO., LTD., announce that their works at Millwall will be closed from to-night (Friday, August 1st) till Monday morning, August, 11th. A small staff will be at the offices to deal with urgent correspondence.

MESSRS. CECIL HODGES & CO., LTD., announce that their works at Hammersmith will be closed from Saturday, August 2nd, until Monday, August 11th, for the annual Volunteer training and stock-taking. A small staff will be available at Balfour House to attend to urgent matters.

THE "OMEGA" ELECTRIC LAMP CO., LTD., of Hammersmith, announce that their factory will be closed from Monday, August 4th, to Saturday, August 9th, both days inclusive, for the annual holidays.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., of Rea Street South, Birmingham, announce the closing of their works from noon to-morrow (Saturday) until the morning of Monday, August 11th.

MESSRS. PARMITER, HOPE & SUGDEN, of Manchester, will also be closed from August 2nd to 11th.

MESSRS. COX-WALKERS, LTD., Darlington, announce the closing of their works from to-morrow (Saturday, August 2nd) until Monday, August 11th, for the annual holiday.

THE CABLE ACCESSORIES CO., LTD., Tividale, also remain closed rom to-morrow until Monday, August 11th, for the same reason.

New Steel Works.—It is reported in the *Times* that MESSRS. ARMSTRONG, WHITWORTH & CO. have purchased upwards of 600 acres near the River Ouse and the Selby and Goole railway, to be used for the erection of steel works which are to give employment to 1,000 men.

Electrical Progress in Japan.—The U.S. Consul at Nagasaki, in a recent report, says that work on the Kagoshima-Sendai branch railway, which extends westwards from the city of Kagoshima, the present southern terminus of the Kiushu division, was expected to be in operation by the end of April. The distance is 30 miles. This branch line is to be operated by electricity, the power to be received from a hydroelectric plant on the Sendai River owned by the Nihon Chisso Hiryo Kaisha, arrangements for which have already been made by the Railway Board. This plant has a capacity of 7,000 H.P.

The electric light and power companies in this Consular district had a very good season in 1912, and all indications point to a more prosperous season for 1913. As a consequence many new companies are projected in all parts of the district.

The new plant of the Nagasaki Electric Light Co. was expected to be in a position to furnish current day and night for both light and power in June. In March it was only available for lighting at night. This company had a very prosperous year, and in addition to declaring an 8 per cent. dividend for 1912, carried forward net profits amounting to an additional 7 per cent. The Nagasaki Electric Tramway Co. has not as yet been able to finance its enterprise, and the promoters have asked for an extension of six months in which to begin the construction work, the time limit for beginning the work having been fixed by charter for February 4th, 1913. The principal promoters are Saseho and Kobe men. They were not able to enlist Nagasaki capital to any great extent, and tried to finance the scheme in Kobe. The capital required was about $600,000. The two suburban electric lines, one from Nagasaki to Tokitsu and the other from Nagasaki to Mogi, also were not able to finance their projects and were waiting for the building of the city lines, their lines being intended as extensions or feeders of the city trams. The electric railway from Sonogi, in Nagasaki Prefecture, to Azambara in Saga Prefecture, *viâ* Ureshimo and Takeo, both hot springs health resorts, and known as the Hizen Railway Co., is rapidly nearing completion, and the section between Sonogi and Takeo is expected to be opened to traffic during the present summer. A cargo of fittings and machinery for this road came from the United States last spring. The Kagoshima Electric Tramway (city) was open to traffic December 1st, 1912, and is in successful operation. The machinery is of American make. The hydroelectric power station at Chijiwa, owned by the municipality of Chijiwa, in Nagasaki Prefecture, has been in very successful operation, and the plant will have to be enlarged to supply the demand for electric light on Shimabara Peninsula.

The large power station of the Kiushu Hydroelectric Co., at Hita, on the upper reaches of the Chikugo River, in Northern Kiushu, is now in course of construction, and is expected to be in operation by October 1st, 1913. This plant will be capable of developing 20,000 H.P., and the promoters expect to transmit power to Moji, Kokura, and Wakamatsu, on the Straits of Shimonoseki.

C. and H. Convention.—This is an age of conventions, and the latest to be started is a private one by MESSRS. CHAMBERLAIN & HOOKHAM, LTD., who last week held the first of what it is proposed to make an annual event, namely, a meeting of all those engaged in the selling of Chamberlain & Hookham meters. The occasion was the coincidence of the arrival in Birmingham of the managers of the Canadian and German subsidiary companies and the return of a director from a long and successful visit to South America. Besides those actually engaged on the selling side of the business, the heads of the works, testing, and accountancy departments were present, so as to bring them into touch with the problems of the outside staff, while the latter were made aware of the way in which the inside staff try to cope with the demands made upon them. The meeting was under the chairmanship of Mr. John Chamberlain, and a long discussion which took place will, it is believed, be to the advantage of the customers of the firm all over the world. Mention was made of the fact that the business of the company had increased five-fold since 1900, and this year's assured business is 25 per cent. greater than that for 1912—a very fine record for a firm who first started making meters in 1887. At the luncheon given by the firm at the Imperial Hotel, Birmingham, mention was made of the length of service with the company of different members of the staff, one of them having been with the firm from the commencement, before they started making meters, and others for long periods up to as much as 25 years.

Fire at Witton.—As some of the various newspaper reports which have appeared relative to the fire which took place last week at the Witton Works of the GENERAL ELECTRIC CO., LTD., may have created an erroneous impression regarding the extent of the fire and its consequences, we are asked to make the following statement:—The company have at Witton separate factories for the manufacture of all electrical plant, carbons, conduits, small motors, switchboards, switchgear, arc lamps, &c. None of these buildings have in any way been injured by the fire, which broke out in one of the various pattern stores adjoining the foundry. These stores were burnt down, but the company's manufacturing arrangements have in no way been interfered with, and all the above-mentioned factories are proceeding with work as usual, and no inconvenience will be caused to customers.

Bankruptcy Proceedings.—JOSEPH SWAINSON (J. Swainson & Co.), electrical contractor, Manchester.—Receiving order made July 26th, on debtor's petition.

F. T. JOHNSON, electrical engineer, Cambridge.—First meeting August 6th; public examination, September 17th: both at Cambridge.

Gas Progress.—In its very extensive area the Gas Light and Coke Co. during the past six months increased its consumers by 8,959, and the number of gas stoves sold and let on hire by 19,372. The sales of gas advanced by 3¼ per cent., as compared with the corresponding period of 1912.

Dissolutions and Liquidations.—Boiler Scalers, Ltd.—A meeting of creditors is called for August 8th at 37, Temple Row, Birmingham. Liquidator, Mr. R. B. Woodward.

Johnson-Lundell Electric Traction Co., Ltd.—A meeting is called for September 4th at 14, Old Jewry Chambers, E.C., to hear an account of the winding up from the liquidator, Mr. A. E. Messer.

The Miners' Lamp Electric Lighting Co., Ltd.—A meeting of creditors is to be held at 42, Spring Gardens, Manchester, on August 12th. Liquidator: Mr. James Blakey, to whom creditors must send particulars by August 11th.

Trade Announcements.—The telephone number and name of Electric Control, Ltd., Queen Anne's Chambers, Tothill Street, London, S.W., has been inadvertently omitted from the Telephone Directory. Instructions have, however, been given to all exchanges, and the firm's friends have only to ask for them by name.

The British Electric Plant Co., Ltd, have removed their head office from 144, St. Vincent Street, to more commodious premises at 78, St. Vincent Street, Glasgow, where all communications should be addressed.

The Armorduct Manufacturing Co., Ltd, have recently opened another depôt at 37, Moorfields, Liverpool (telephone, Central, Liverpool, 5096), where a large stock of their specialities will be held.

Catalogues and Lists.—Messrs. Balcke & Co., Ltd., Broadway Court, Broadway, Westminster, London, S.W.—Leaflet describing, with diagrams, their Balcke wet-air filters.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—Two leaflets, one, No. 34, illustrating and giving tabulated prices and code-words of high tension ironclad switchgear for mining and sub-station work (2,000 to 6,000 v.); the other, No. 49, particularising their Clapper switches for remote control.

The Lazilite Co., 5, Baldwin's Gardens, Gray's Inn Road, London, E.C.—Illustrated folder giving particulars and prices of "Lazilite" extension electric light fittings and extending telephone holders.

Messrs. Electrical Installations, Ltd., of 27 and 28, Martin's Lane, Cannon Street, London, E.C., have sent us one of their desk blotting cases. It is a very neat production, in black and gold. The large memoranda block on the right hand and a telephone number index on the left can be closed over on to the blotting pad when not in use, making a very compact arrangement.

Conditions in Canada.—The *Times* Toronto correspondent quotes Sir Thomas Shaughnessy as stating that the present economic situation in the Dominion does not occasion anxiety. He fully expects conditions to become quite normal late in the autumn. He attributes the falling off in public works under municipal control almost wholly to world-wide rather than to domestic financial conditions.

LIGHTING and POWER NOTES.

Birmingham.—Proposed Loan.—The Electric Supply Committee has recommended that application be made to the L.G.B. for sanction to borrow £6,300, the estimated cost of erecting two more cooling towers at Summer Lane generating station.

Blackpool.—During the past three months 107 new consumers have been obtained, as compared with 54 in the same period of 1912.

In connection with the supply of electricity by the Corporation to the St. Anne's and Lytham Tramways Co., the minimum guaranteed to be taken per year by the company has been reduced from 122,000 to 110,000 units.

Bradford.—Plant Extensions.—The city electrical engineer (Mr. Thos. Roles) has just issued a long report upon the advisability of installing additional plant at the Valley Road Electricity Works, and recommends the provision and erection of the undermentioned plant at the estimated costs set out:—One 3,000-kw. turbo-generator, complete with exciter and condensing plant, £10,000; steam, exhaust, water, and drain piping, £2,320; switchgear and cables for generator, £2,950; air filtration plant for generator, £350; two cooling towers complete, erected on site, £4,331; induced draught plant for 12 boilers, including fans, motors, switchgear, dampers, &c., £3,078; suction ash plant for handling ashes from 12 boilers, £2,075; one rotary feed pump, and two sump pumps, £600; two 1,500-kw. rotary converters and switchgear, £14,110; oil storage and filtration plant, £300; building work, including subway, foundations, pump room, completing switch house, &c., £8,163; switchgear for six extra-high-tension feeders, £2,400; storage battery capable of discharging 5,000 amperes for one hour, £16,756; switchgear and connections for battery, £5,985; battery boosters, £5,565; building for battery and extension of switchboard gallery, £7,267; total, £86 259. There is no doubt, Mr. Roles states, that the power users in the city are now recognising the great advantages to be obtained by the use of electricity for the driving of machinery of all descriptions, and especially the value of alternating-current supply for the driving of textile machinery. In view of the success which has been attained, more especially during the past two years, it is certain that electricity will be used for the driving of a large proportion of the new textile factories which are erected in Bradford. The scheme, which has been approved by the City Council, is referred to on page 167.

The electrical engineer has been instructed to light half-a-dozen main road crossings in the city with 500-watt lanterns, at an annual inclusive charge of £7 each; also to light certain roads in the Thornbury and Tyersal districts at an annual charge of £4 per 200-watt lantern, and to convert certain gas lamps at an inclusive annual cost of £2 12s. 6d. per lamp.

Brighton.—Workhouse Lighting.—The B. of G. has decided to have the nurses' quarters at the Workhouse lighted by electricity in place of gas. The initial outlay will be covered in three years by the saving as between the cost of gas, 2s. 10d. per 1,000 cb. ft., and electricity.

Bury.—Generating Station Extensions.—Mr. S. J. Watson (engineer) has reported to the Electricity Committee that in order to deal with the requirements of additional consumers, it would be necessary to provide a third set of generating plant at the Chamber Hall station, and to make provision for further plant by extending the buildings. The Committee has decided to recommend the Council to make application to the L.G.B. for sanction to borrow £55,000 for the purposes mentioned.

Bushey.—The U.D.C. is having prepared an agreement with the Watford U.D.C. for a supply of current under a prov. order being applied for by Watford.

Canada.—According to the *Standard*, the provincial Hydro-Electric Commission has let contracts for the construction of a generating plant at Wasdells Falls. Contracts have also been let for the extension of the Dundas, London, and St. Thomas stations, and the work of building the transmission line to Windsor at the extreme western end of the province is being rapidly pushed forward.

As a result of occasional interruptions to the supply of electricity from Niagara Falls the city of Toronto will erect an auxiliary steam plant to serve in cases of emergency at a cost of £205,000.

Chester.—At a meeting of T.C. it was stated that in connection with the electricity undertaking the number of units sold during the year exceeded that of the previous year by nearly a quarter of a million, that the number of consumers added during the year was far greater than in comparison with any other year, and that in spite of the increased cost of coal, the cost per unit for generating the current was less than ·889d.

Chesterfield.—Application has been made to the B. of T. by the Corporation for consent to overhead transmission from the electricity works in Chatsworth Road to Bryan Donkin Co.'s works and from there to the works of the Chesterfield Tube Co., Ltd., for the transmission of electrical energy at a pressure of 6,600 volts.

Cuba.—Permission has been asked of the Government to establish electric light plants at Madruga, San Nicolas, Catalina de Guines, Jaruco, Carabello, Bainoa, San Antonio, and Rio Blanco del Norte, all in Habana Province. Ramos Valderas has been given authorisation by the Jovellanos municipality to establish an electric plant in that city, situated in Matanzas Province. Manuel P. Cardenas is petitioning for permission to establish an electric plant in Moron, Camaguey Province. Luis Torres has solicited Government permission to establish an electric plant in Los Arabos. Messrs. Mon and Fernandez have received the necessary Government authorisation to install an electric plant at Isabela de Sagua, the north coast port of Sagua la Grande, Santa Clara Province. Sr. Rafael Rodriguez has received authorisation to install an electric plant in Calimete. Light service will include also the towns of Manguito and Amarillas. All places mentioned are in Matanzas Province.—*The Cuba Review.*

Doncaster.—L.G.B. Inquiry.—At the recent inquiry relative to the application for powers to borrow £12,500 for the extension of the electrical undertaking, the town clerk stated that the Corporation had recently applied for powers to extend the area of supply and had already obtained sanction to include the adjoining urban district of Wheatley. At the present time it was applying for power to extend the area of supply into the urban districts of Balby and Bentley, and the provisional orders had passed the second reading. It had also had applications for current from a number of manufacturers. He further stated that the Corporation had recently applied to the Light Railway Commissioners for powers to extend the tramway system to Brodsworth, a colliery district to the north of the town and to Warmsworth, another colliery district to the westward.

Edinburgh.—The Electric Lighting Committee has decided by a majority that the surplus of £2,169 be used for the reduction of capital account. The minority contended that the surplus should be applied to the relief of the rates. The estimated surplus next year is £1,800.

Exeter.—Electric Cooking.—The T.C. has authorised the electrical engineer to expend £150 on electric cooking appliances for demonstration purposes.

Finchley.—Annual Report.—According to the report of Mr. Syrett, the U.D.C.'s electrical engineer, there was a net profit of £1,421 on the working of the undertaking during the 12 months ended March 31st last. The gross profit was about 11·5 per cent. on the capital outstanding at the end of the year, and approximately 8·65 per cent. of the total capital expended on the undertaking up to March 31st. There was an increase of 133,663 in the number of units sold to consumers, this number being nearly double the increase of the previous year.

Fort William.—Street Lighting.—The T.C. has approved of a proposal of the Electric Lighting Committee to carry the wires for the lighting of the eastern section of the burgh overhead on poles, each pole to carry a 30-c.p. lamp, instead of the present 16-c.p. lamps on the town pillars, which are placed 90 yards apart.

Halifax.—The Borough Treasurer's statement of accounts of the electricity undertaking for the past year, shows that the income from the sale of electricity amounted to £48,025, and the aggregate expenditure incurred was £38,948, leaving a balance to appropriation of £6,886.

Haslingden.—A Sub-Committee has been appointed to go into the question of the applications for electricity in the Helmshore district.

Hastings.—The Borough Education Committee on July 25th, decided to have the electric light installed at Mount Pleasant, Clive Vale, Ore, Priory Road, and West St. Leonards Schools, at an estimated cost of £174.

Hyde.—The Generating Station Committee of the Joint Board has decided to leave the question of the street lighting at Hyde to the engineer.

Ilford.—The U.D.C. has fixed the price for current for the tramways for the coming year at $1\frac{1}{16}$d. per unit.

The Wanstead U.D.C. has arranged with the Ilford Council for a supply of energy for power purposes at the sewage works at 2d. per unit, or 1d. for a minimum consumption of 10,000 units per quarter.

A battery sub-station is to be erected, at a cost of £2,400 (battery, £1,650; booster, switchgear and connections, £550; and diversion of feeder and distributors, £200), to provide for the satisfactory supply of extra load anticipated in the Goodmayes district.

Leyton.—The electrical engineer requires a supply of public lighting lanterns, also three additional arc lamps. The architect of the Goodall Road and Mayville Road handicraft centres has been instructed to obtain quotations for the installation of electric light thereat.

Listowel.—Workhouse Lighting.—At a meeting of the B. of G., it was decided that electric light be installed in the workhouse, and that the Listowel Electric Light and Power Co. be requested to submit an estimate of the probable expenditure connected with the proposed scheme, and that details of the cost of lighting the institution with petroleum for the past three years, be obtained. It was stated that the cost per year for oil alone, exclusive of lamps, &c., would be about £50, whereas the cost of electric light would be about £35.

London.—Marylebone.—Sales Department Report.—Messrs. Price, Waterhouse & Co., in their report on the working of the B.C.'s Sales Department of the electricity undertaking during the year ended March 31st last, state that:—"The difficulties which we experienced last year in accurately separating the accounts relating to this section are substantially unaltered. We have drawn up an approximate profit and loss account, and this is divided into two parts, the first of which covers the proceeds and the direct cost of articles sold and services rendered by the sales section. The turnover shows satisfactory increases in respect of all items except sales and work done. The falling off in this particular, which very nearly counterbalances the other increases, is, in our opinion, accounted for by the change in the method of working, whereby the department no longer undertakes the wiring of new buildings. The turnover of the department was £21,629, and the direct cost £16,384, leaving a gross profit of £5,245. It, therefore, appears that the price charged for supplies and work done includes a gross profit of 24½ per cent., or an addition of 32 per cent. to the direct cost of the work done. The second part of the account includes the apportionment of the general expenses of the department. These expenses amount to £4,714, exclusive of interest on the capital employed, or 21¾ per cent. upon the turnover already referred to. Deducting these expenses from the gross profit shown above, there would remain an estimated net profit of £530, which is equivalent to 2½ per cent. upon the turnover, or 3½ per cent. upon the capital of £15,000, which we estimate to be the amount invested in this department."

In discussing this matter in Council, Mr. Duncan Watson moved as an amendment that the Council disagree with the report as presented, pointing out that the allocation of the charges connected with the department, saddles the electricity undertaking with an unnecessary expense. In the course of his speech, Mr. Watson said that the pretext for introducing the sales department in the first instance was, they were told, because tradesmen in the borough were dishonest, incompetent, and charged exorbitant prices, and their work was unsatisfactory. He added that the sales department was incompetent and did unsatisfactory work, while the price charged was nearly 30 per cent. higher than it ought to have been, therefore the whole case for the existence of the sales department fell to the ground. In no sense had it been proved that any increase in units could be attributed to the work of this department. The resolution disagreeing with the report was carried

The chairman of the Electricity Committee, Colonel Hopkins, announced his resignation.

The following motion by Mr. Duncan Watson was held over as a quorum was not present:—"That a Special Committee be appointed to investigate the position of the electrical undertaking as affected by the latest tariffs and as to the abnormal cost of the sales department in connection with new business and to report to the Council on the future prospects of the undertaking."

The L.C.C. has agreed to advance £20,000 for 15 years on account of the loan of £42,500 sanctioned by it for the extension of the electricity plant. A further application is to be made for a loan of £10,825 required in respect of extensions.

Metropolitan Asylums Board.—The Board is renewing for a further period of seven years its agreement with the County of London Electric Supply Co. for the supply of energy to the Tooting Bec Asylum. The company offers to supply energy for the additional buildings on the existing terms of 2¼d. per unit for lighting and 1d. per unit for power and heating.

The managers are to enter into an agreement with the South Metropolitan Electric Light and Power Co. for the supply of current to the Brook and Park Hospitals upon certain conditions which include a fixed charge of one guinea for each kilo-volt ampere of the maximum demand per quarter, and 1¼d. per unit for the whole of the energy metered. The agreement to be for a period of 21 years terminable at the end of the first seven years or at the end of any subsequent year. The cost involved in connection with the provision of accommodation for the company's transformers and for the change over to low voltage metallic filament lamps, including transformers and alterations to mains and wiring, is put at £550 for the Park Hospital and £700 for the Brook Hospital.

Woolwich.—Proposed Loan.—The L.C.C. is to be asked to advance the following amounts required in connection with the electricity undertaking:—General main extensions, £1,500 (repayable in 25 years); house services, £1,100 (repayable in 12 years); meters, £630 (repayable in 10 years); hire-purchase, £1,000 (repayable in 10 years). Application is also to be made for sanction to borrow a further sum of £15,000 on account of the scheme of extension at the Globe Road generating station, £9,000 being for machinery.

Long Eaton.—L.G.B. Inquiry.—An inquiry was held on July 23rd into the application of the U.D.C. for a loan of £10,000 for extension to the electricity works, by which a 500-kw. engine and condensing plant will be installed. There was no opposition.

Maryport.—Prov. Order.—The U.D.C. has received from Messrs. Foote & Milne, Ltd., an intimation of their intention to apply to the B. of T. for a prov. order for electricity supply in the town.

Paisley.—Year's Working.—The electricity department has closed the year's accounts with a profit of £112, which it is proposed to carry forward. The cost of coal was nearly £1,300 more than in the previous year, and a deficit was looked for, but as there was a big increase in the demand for current the department was enabled to close the account on the right side. The sale of current went up from 2,930,773 units to 3,323,528 units, an increase of 13 per cent. The estimates for the year show a profit of £154, but as these include an expenditure of £500 for the renewal of arc lamps—a charge which might be spread over several years—the statement is better than it looks.

Shipley.—Plant Extensions.—The U.D.C. has decided to install further turbine plant at the electricity works at an estimated cost of £15,300, and to erect a new engine house for the plant. A loan for the expenditure is to be applied for.

Southampton.—The borough engineer and borough electrical engineer have been instructed to submit a joint report upon the system of lighting Shirley High Street, together with an improved scheme of lighting and estimate of cost. The B. of T. has submitted a draft order permitting the Corporation to supply energy to Chilworth. Tenders are required for the supply of a boiler and generator at the electricity works.

Slough.—New Plant.—The U.D.C. has passed plans of extensions at Chalvey by the Slough and Datchet Electric Supply Co., including a new water cooling tower and engine room.

Stoke-on-Trent.—Annual Accounts.—In moving the confirmation of the Electricity Committee's proceedings at the meeting of the T.C., Alderman H. Leese said the total receipts from the undertaking were £46,425, an increase of £4,131 on the previous year. The gross profits at the different works were as follows:—Burslem, £4,596; Hanley, £8,535; Longton, £1,873; and Stoke, £3,198; but after repayments on loans and sinking fund, the net amounts were:—Burslem, £838; Hanley, £222; Stoke, £299; and Longton, £141 (loss). The average price for lighting and power had been lower than for most of the large towns, and he thought the old plant had done very well. When the new works were running he anticipated they would have much better results. Councillor Coates drew attention to the amount of business done compared with the net profits, and to the fact that nothing had been set aside for depreciation on a capital of over £238,000. From £5,000 to £7,000, he urged, ought to be made annually to place the undertaking on a sound basis. Alderman Leese said they were practically providing for depreciation by their substantial reductions of loan charges each year. He anticipated that the new central power station would have the effect of bringing about great economies and increasing the profits.

Sutton (Yorks.).—Prov. Order.—The Hull T.C. has given notice to the local authorities of the intention of the Council to apply for a prov. order for electric light at Sutton.

Welshpool.—Prov. Order.—At a meeting of the T.C. a letter was submitted from Mr. J. H. Edwards, Wrexham, giving notice of his intention to apply for a prov. order to supply electricity within the Council's area.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—Annual Report.—The accounts of the Corporation tramways for the year ended May 31st, show that the total revenue for the year was £80,166, being an increase on the previous year of £2,985. The working expenses amounted to £43,206, or an increase of £2,236. Interest, sinking fund, depreciation and renewals absorbed £24,906, a decrease of £510. The profit for the year was £12,524, the largest yet obtained in the history of the undertaking. The car-mileage was 1,738,966, an increase of 95,719 miles, and 19,990,711 passengers were carried on a system of almost 14½ miles. For traction purposes 2,110,964 units were used, an increase of 217,887 units. The cost of electrical energy was £7,138, equal to '81d. per unit, as against '86d. for the preceding year. Satisfactory results were obtained from the new pay-as-you-enter cars, 10 of which are in operation.

Bradford.—New Rolling Stock.—Having considered the report of the tramways general manager embodying proposals for expenditure on new equipment, car bodies, trucks, &c., the Tramways Committee intends to incur the following expenditure on rolling stock during the year commencing April, 1914:—Fifty trucks, estimated cost, £4,050; 100 motors, £10,600; 50 resistances, £412; 100 circuit breakers, £215; 100 controllers, £2,400; 50 power brake sets, £2,500; 50 sets power circuits, £875; 10 car bodies rebuilding, £2,250; total, £23,302. From this total is to be deducted, £2,500 representing the value of old equipment.

Bury.—Owing to the demands of the B. of T. in connection with the Heywood Street branch of the tramways, the Tramways Committee has decided to discontinue the service (outward) from the date of the next meeting of the T.C. The suggestions of the board, if acted upon, would involve an expenditure of £1,760. In view of the loss at which the experimental service was previously run the Committee cannot see its way to undertake the work.

Continental Notes.—Russia.—It is announced that the Moscow-Windau-Rybinsk Railway Co. is prepared to proceed with the conversion to electric traction of the suburban line between St. Petersburg and Pawlowsk, at an estimated expenditure of £100,000 on the definite grant of the concession for the St. Petersburg-Orel railway.

Austria.—A further stage has now been reached in connection with the proposed conversion to electric traction of the Vienna City Railway and the construction of underground electric railways in that city, concerning both of which two banking groups have hitherto been in competition. On the one hand, there is a group of Vienna banks and German and Austrian electrical firms, including the Siemens-Schuckert Works; while the other group is composed of the French Omnium Lyonnais and the Banque Centrale de Province. It is now stated that the two syndicates have come to a provisional arrangement to co-operate in the financing of the schemes. The proposal is for each of the groups to subscribe one-half of the share capital of £2,080,000 with which the construction company would be equipped, and the loan capital of £6,000,000 would be raised to the extent of one-fourth by the Austrian group and three-fourths by the French syndicate, which would be allotted for French works 25 per cent. of the orders for the city and underground railways. Apparently, the placing of this percentage of the orders has yet to be agreed to by the German interests, whose share in the contracts for rolling stock and machinery would be reduced by the amount of the work given to French firms. The definite conclusion of the agreement between the two groups is expected to take place when the French group has ascertained whether consent will be given, as is confidently believed, to the admission of the shares and loan capital to quotation on the Paris Stock Exchange; and, in this event, the French Société Générale will join the group. The proposed company will be purely a construction enterprise, as the city railway will presumably continue to be worked by the State, whilst the Vienna Municipal Council will undertake the operation of the underground railways.

Keighley.—The Tramways Committee has granted the request of the men for a week's holiday, with pay, in the year, and it is to commence with the present year. The holiday has been given on the specified condition that the men shall not, in their holiday week, take advantage of the chance of getting double pay by doing similar work elsewhere.

Annual Accounts.—The annual statement of the tramways and motor-'bus undertakings for the year ended March 31st last, submitted last week, shows that the total traffic revenue had decreased by £742, but an increase of £81 in sundry revenue brought the net decrease in total revenue to £680. This drop is stated to have been largely due to the bad summer of last year, and to the cheaper facilities—2½ miles for a penny—given to the public. The total revenue from tramways had been £9,158, the gross profit being £3,187. The number of passengers carried had been 3,099,272.

Railless Traction Experiment.—It was reported that the experimental railless car which had been running since May 3rd last, had created a favourable impression. From that date to July 14th, the car had run 2,126 miles, the revenue having equalled 12·54d. per mile. In congratulating the Committee upon the results of the year's working of the tramways, and the railless experiment, Alderman King urged the authority to proceed carefully with the latter project, and "not to make the blunder which they had made with the motor-'buses." He advocated the entire abolition of the motor-'buses. The reports and accounts were adopted.

Liverpool.—A return, prepared by Mr. C. W. Mallins, the tramway manager, shows that the total revenue for the five days of the King's visit to that part of the country has established a record. The total receipts for the five days amounted to £13,974, and there were 2,856,896 passengers carried.

Leyton.—The Council has accepted the offer of the Postmaster-General to run aerial cable over the Council's trolley wires, where telegraph and telephone cables cross, provided the Council pays half the difference in cost between the provision of the cable and open wires. A modification of the Council's agreement with the L.C.C. for through running on the Lea Bridge Road route has been made, whereby the receipts for cars on the through route are to be pooled and divided according to the mileage run by each authority, for a period of three months from August 1st next. The proportion of mileage run by each authority is to be on the same basis as at present.

London.—L.C.C.—The Council has decided to expend £25,000 (a sum which includes £7,000 for turbo-generator switchgear) on the provision of protective devices with the object of guarding against breakdowns of the tramways generating plant and localising same.

Manchester.—Proposed All-night Cars.—A petition, signed by 3,553 night workers of Manchester, has been presented to the Tramways Committee. The petitioners ask for a night service of tram cars or motor-'buses. The matter is receiving the attention of the Committee.

Preston.—The appointment of a sub-committee of the Corporation is being recommended for the purpose of considering tramway extensions.

Rawtenstall.—Annual Accounts.—Traffic receipts on the Rawtenstall tramway system last year amounted to £25,276, against £23,938 in the previous year, and the total revenue for the year was £26,648, as compared with £25,243. The working expenses were £15,106, as compared with £13,514 for the previous year. The gross profit was £11,542. The loss on the year's working was £517, and to meet this and provide £982 for the renewals fund £1,500 will have to be provided from the rates.

TELEGRAPH and TELEPHONE NOTES.

Australia.—In the early stages of telephone construction in New South Wales, some 300 lines were erected by private users before the Government assumed control of the system, and the owners of these lines were granted the right in perpetuity to retain them on payment of £5 per annum. An Act was passed in 1911 to empower the Government to resume the lines on payment of compensation, to be settled by arbitration, and these powers are now being enforced, greatly to the annoyance of some 250 firms that will be affected.

Poulsen System.—Newcastle (N.B.) is to be the Atlantic Coast station of the Universal Radio Syndicate for the wireless service between the Dominion and Ireland.

"Jamming" in Naval Manœuvres.—In reply to questions in the House of Commons, Mr. Churchill said that it was not the universal custom during manœuvres to attempt to interfere with the opposing fleet's messages, though it might at times have been attempted for short periods. It was not worth the trouble involved and the delay caused to the communication with one's own fleet, and had in practice often been found abortive. It was possible to tap the messages.

St. Kilda.—The *Daily Mirror* wireless station has opened communication with the mainland.

Imperial Communications.—A sub-committee of the British Empire League has been formed, under the name of the Imperial Communications Committee, to keep in touch with the general question of improvement and cheapening of postal and telegraphic communications in the Empire, to collect facts and arguments and to bring them to the notice of the public and of Parliament and Ministers.—*Times.*

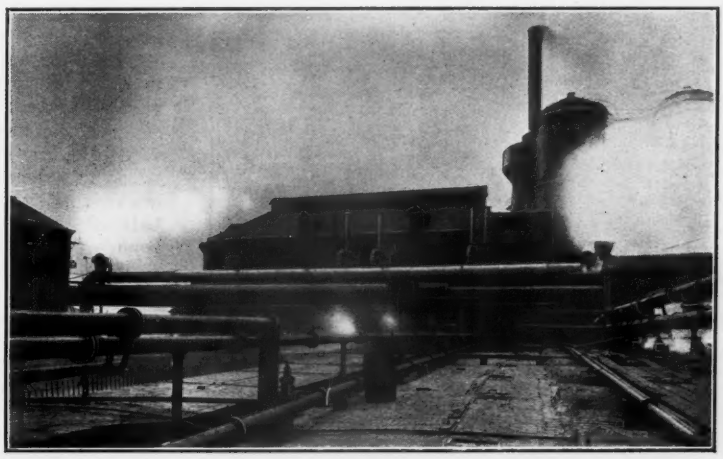
(*Continued on page* 183.)

ELECTRICITY DEVELOPMENTS IN WEST HARTLEPOOL.

The Corporation Waste Heat Generating Station.

Electricity supply in West Hartlepool dates back some 12 years, the original generating station of the Corporation in Burn Road having been opened in January, 1901.

Ever since its inception, Mr. H. F. Friederichs, the present borough electrical engineer, has controlled the destinies of the undertaking—indeed, it is not too much to say that it is due to his early appreciation of the necessity for developing the industrial possibilities of the area, which offers comparatively little scope in the matter of electric lighting, that the West Hartlepool electricity department has reached its present satisfactory position.



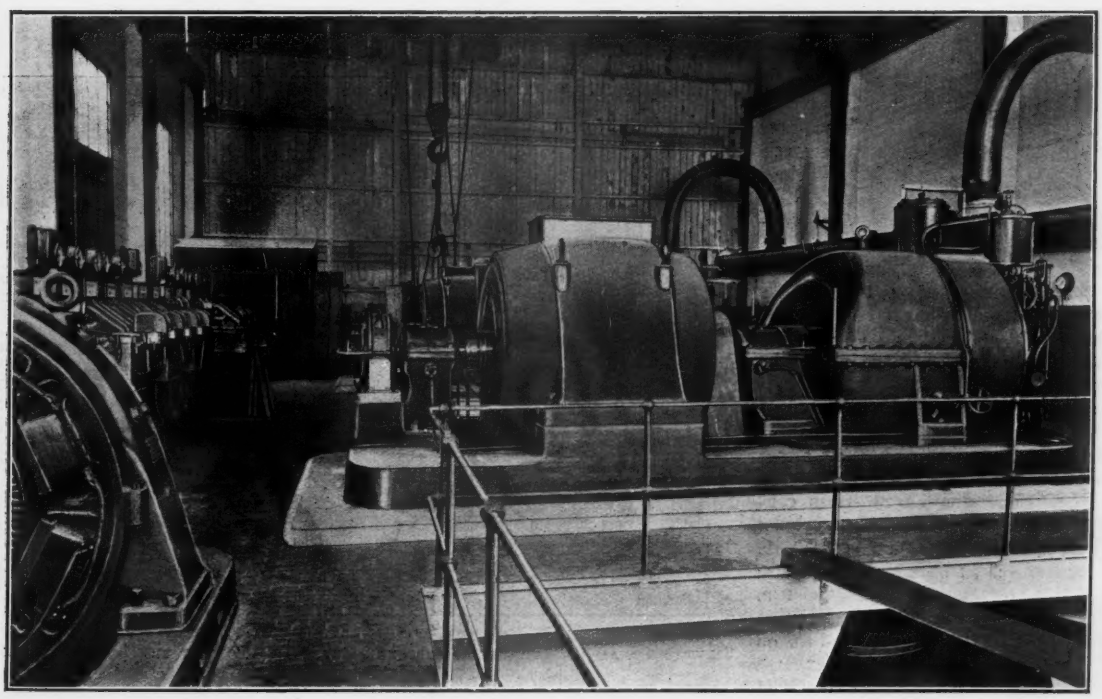
Blowing Engine-House and Exhaust Steam Main Leading to Corporation Power Station (on Left).

Industrially, both West Hartlepool and its smaller sister, Hartlepool, are dependent on the shipping and allied trades, and the local iron and steel works; and it is in connection with one of the latter—the Seaton Carew Iron Co.'s works—that the latest development of the electrical undertaking, viz., the construction of a waste heat power station has taken place.

The Corporation is the first municipal authority to adopt the system of generating electricity from waste steam obtained from outside sources, although the Cleveland and Durham Power Co., which strongly opposed the carrying out of this scheme by the Corporation, has, of course, had several such stations in use for a considerable time.

For the past five or six years the Corporation has supplied the Seaton Carew Iron Co. with some 1½ million units per annum, and under the agreement which has resulted in the erection of the new power station, the company's present electrical requirements will be supplied free in exchange for exhaust steam which was previously blown to atmosphere.

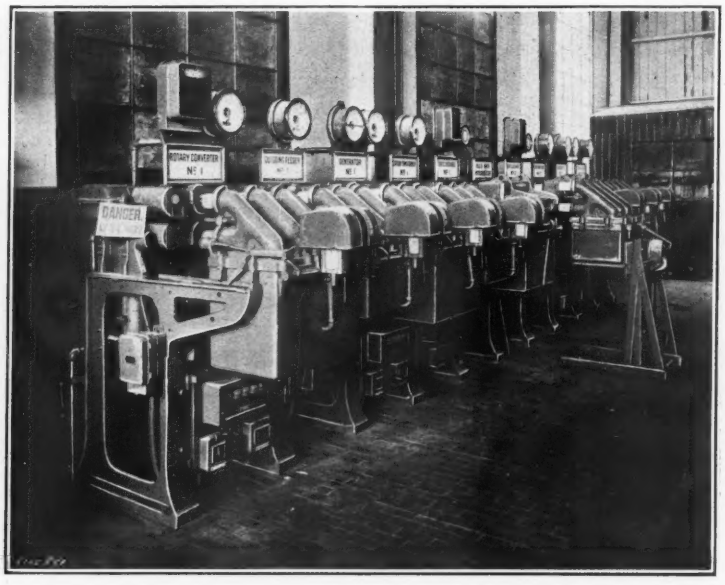
The new power station consists of steel frame turbine house, 40 ft. wide and 70 ft. long, with a temporary end, to allow of extensions; the walls are filled in with 4½ in. concrete reinforced with expanded metal, while the roof, of wood, is covered with Polite tiles. The ground space, how-



Mixed-Pressure Turbine Sets, Ironclad Switchgear, and Rotary Converter (on the Left); West Hartlepool Waste Heat Power Station.

ever, provides for a coal-fired boiler plant adjacent to the engine house, in the event of this being required in the future.

The present steam requirements of the plant, however, are supplied from the exhaust steam from six furnace-blowing engines, which in turn are supplied with steam at 80-100 lb. pressure from a battery of 16 gas-fired boilers, evaporating some 200,000 gallons of water per day. The



Ironclad 6,000-volt Switchgear at the New Power Station.

blowing engine exhausts are led into a 33-in. diameter riveted steel main, fitted with an automatic valve at each end balanced to ½ lb. pressure; the steam, at slightly above atmospheric pressure, passes through a Princeps oil separator prior to entering the turbine house. In the latter are installed two Richardsons, Westgarth mixed-pressure turbines, of the Curtis type, running at 2,400 R.P.M., coupled to 1,250-K.V.A. Siemens three-phase alternators, which have an efficiency of 93 per cent., and are designed for a 25 per cent. overload for two hours.

The turbines are three-stage machines, which normally run on two L.P. stages; owing, however, to the blowing engines being partially shut down at intervals, due to flue-cleaning operations, provision has been made for running the turbines on H.P. steam from the existing boilers, from which a 10-in. solid-drawn steel main runs to the turbine house.

Both L.P. and H.P. governor valves are provided on the turbines, and are interconnected, so that in the event of the L.P. steam giving out, the H.P. valve is opened automatically, passing steam through all the three stages of the machine. The guaranteed steam consumption per KW.-hour of the turbines working on exhaust steam is 31·9 lb. on full load; 37·9 lb. on half load; and 53 lb. on quarter load. On H.P. steam, the expected steam consumption is 23·7 lb. on full load, and 29·3 lb. on half load. The turbines each exhaust direct into a Contraflo condenser of 5,400 sq. ft. cooling surface, which, together with centrifugal circulating and Kinetic air pumps and tanks, are installed in the basement below the turbine floor.

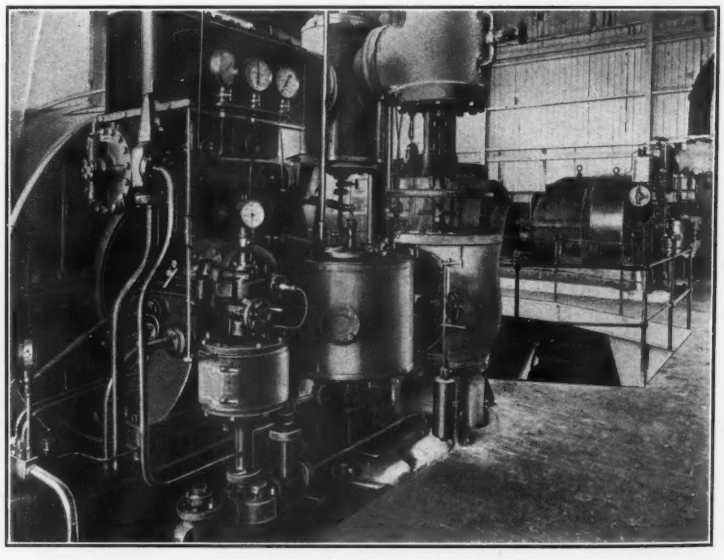
The Kinetic air pump equipment is similar to that which was fully described in our issue of July 4th last, except that in this case the condenser auxiliaries are motor-driven—the Kinetic air pumps being each coupled to a 28-H.P. motor, speed 2,400 R.P.M., and each circulating pump to an 82-H.P. motor running at 600 R.P.M.

The condensate is passed through a Lea recorder, which provides a check both on turbine steam consumption and the steam supply—a minimum supply being guaranteed in compliance with the L.G.B.'s wishes; from the recorder the water discharges into a hot-well underneath and is then, under the agreement, returned (by a small pump coupled to a 4-H.P. motor) to the Seaton Carew Co.'s boilers. The condensing plant is connected through 22-in. diameter suction and delivery pipes to three Morrison Cascade type natural draught cooling towers, each capable of dealing with 115,000 gallons of circulating water per hour—the make-up water being supplied from the company's deep well. The towers, which are of wood, each measure 30 ft. × 60 ft. × 75 ft. high; the internal water distributing system is somewhat novel as the circulating pump discharge is distributed through stout deep troughs, from which it falls through a series of short pipes, on to small specially-shaped spreaders, each of which creates an umbrella-shaped spray. The latter falls on to specially shaped and arranged lats, and is directed by means of baffles into a lower series of troughs, this arrangement being repeated three times before the water reaches the tank underneath. By means of the baffle system the air is circulated through the tower in such a way as to obtain the maximum cooling effect.

It is claimed that the trough construction in these towers ensures even distribution of the water, and is proof against troubles due to warping.

Turning to the electrical equipment, the Siemens alternators are of the totally-enclosed type, fitted with rotor fans, one at each end, for the forced circulation of cooling air; the latter is drawn from the basement through Sturtevant air filters and discharged into the engine room. The alternators supply three-phase current at 6,000 volts, 40 cycles, excitation being provided by 13-KW. shunt-wound interpole 100-volt machines direct-coupled to the alternator shafts. Each alternator has an earthing resistance and switch.

The H.T. switchboard consists of 10 Reyrolle ironclad direct-operated switch units, the constructional features of which are, or ought to be, familiar to our readers.

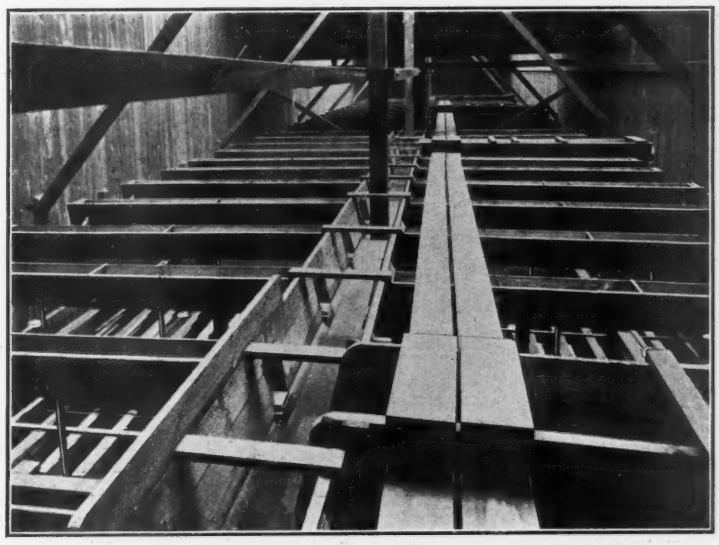


View of Steam End of Mixed Pressure Turbines, Showing the Interconnected Exhaust and High-Pressure Steam Valves.

Roughly, each turbine unit has its own set of switch panels, consisting in each case of one feeder, one machine, one station transformer and a static discharge panel, with an inter-connecting switch between the sets. An extra panel is provided on one side for a rotary converter, which supplies the Seaton Carew Co.'s works.

The machine panels are fitted with overload trips, and Merz-Price protective gear is applied to the H.T. feeders; a swinging synchronising panel is provided.

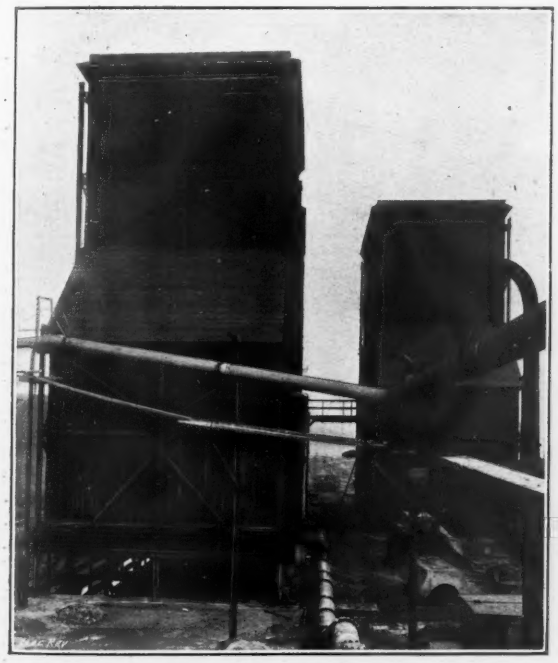
The "unit" arrangement is applied to the station auxiliary motors, which in the case of each condenser are supplied through a separate transformer. Two Siemens oil-cooled 150 - K.V.A. station transformers are installed for this purpose in the basement, which are coupled to the 6,000-volt bus-bars and each supplies secondary current at 440 volts through a C.I. distribution box fitted with Reyrolle switch fuses to its own section of the plant and for station lighting.



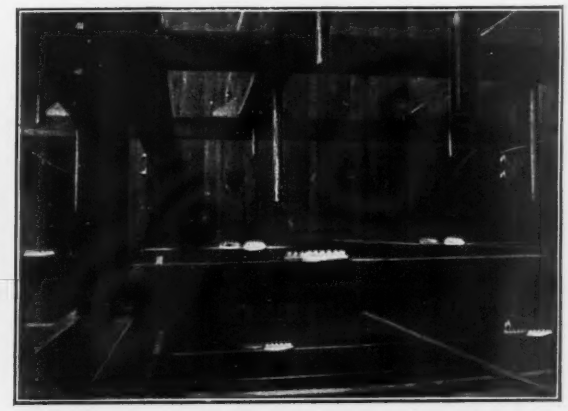
Interior of Morrison Cascade Cooling Tower, Showing Distributing Troughs.

An interconnecting switch is provided between the distribution boxes so that one transformer can, in emergency, supply both of them.

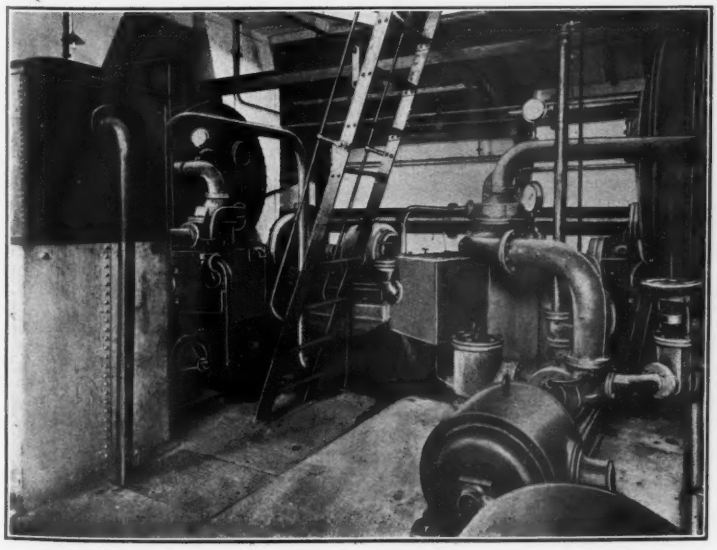
The rotary converter plant, to which reference has been made, is installed in one corner of the engine room and consists of a 500-KW. six-phase machine, speed 600 R.P.M., coupled to a midwire booster and starting motor, and arranged for self synchronising by the Rosenberg method. The machine, together with the oil-cooled transformer in the basement and L.T. switchgear, was supplied by the Westinghouse Co., who have also supplied several similar self-synchronising converter plants which have been installed in connection with the scheme.



Three Cooling Towers at the New Power Station; also H.P. Steam Main to Turbines.



View of Splashers under Troughs in Cooling Tower.

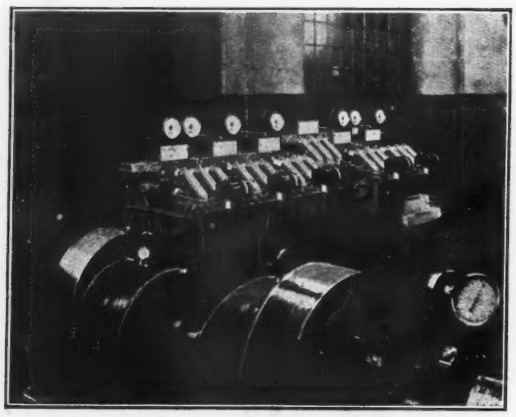


Contraflo Condensing Plant, with Kinetic Air Pumps, Tanks, &c., in Basement.

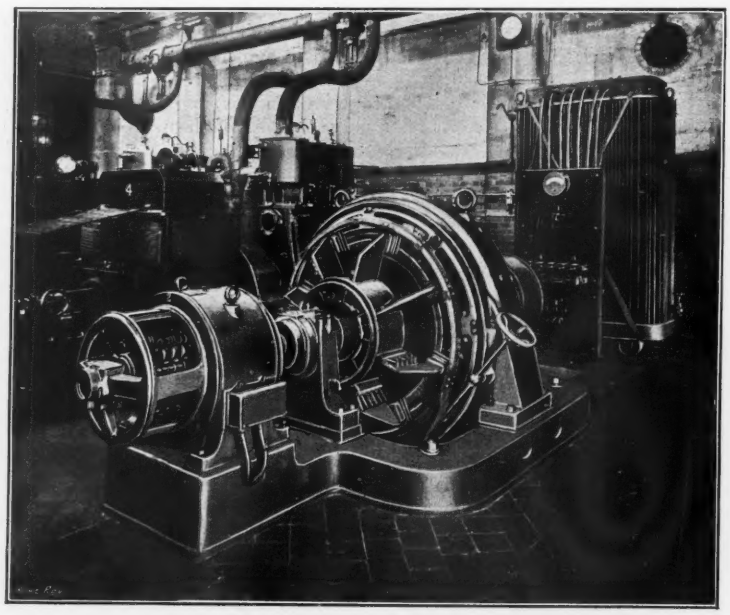
The supply to the Seaton Carew Co. is at 460 and 230 volts direct current, by means of overhead wires running to the works sub-station; this is also coupled to the old generating station in Burn Road, and the latter is thus able to supply energy to the new power station, through the rotary, for running the condenser auxiliaries, when starting up the turbines on L.P. steam.

The two 6,000-volt feeders leaving the new station are Callender ·1 three-core paper-insulated lead-covered cables, laid solid in bitumen, together with the pilot and telephone wires; one feeder runs

direct to the old generating station, about ½-mile away, and the other reaches the same point *viâ* a sub-station at the South Durham Steel and Iron Co.'s works, where a 400-KW. Westinghouse rotary is installed. The Burn Road generating station, which has now become the Town sub-station, contains two 500-KW. rotary converter plants — duplicates of that installed at the new power station—and these will supply the direct-current load on the town network, thus enabling the 1,500 KW. of high-speed engine plant installed there to be shut down and held in reserve.



REYROLLE IRONCLAD H.T. SWITCHGEAR IN THE OLD GENERATING STATION.



ONE OF TWO 500-KW. SELF-SYNCHRONISING ROTARY CONVERTER SETS AT THE OLD STATION.

The H.T. supply is controlled by Reyrolle ironclad switch units, this type of H.T. switchgear having been used throughout; the arrangement consists of two sets of feeder and rotary switch units coupled through an interconnecting switch, with an extra switch unit for the supply to the Hartlepool Pulp and Paper Works, where a 400-KW. Westinghouse rotary converter plant is installed.

Both the South Durham Co. and the Paper Works are new consumers; the former will probably require between one and two million units; and the latter, possibly, two million units per annum. In addition to the foregoing, the local tramways will require half a million units per annum, which will be supplied through two 300-KW. B.T.H. rotaries at Burn Road, it having been decided to scrap the 350 KW. of generating plant installed in the original tramways generating station.

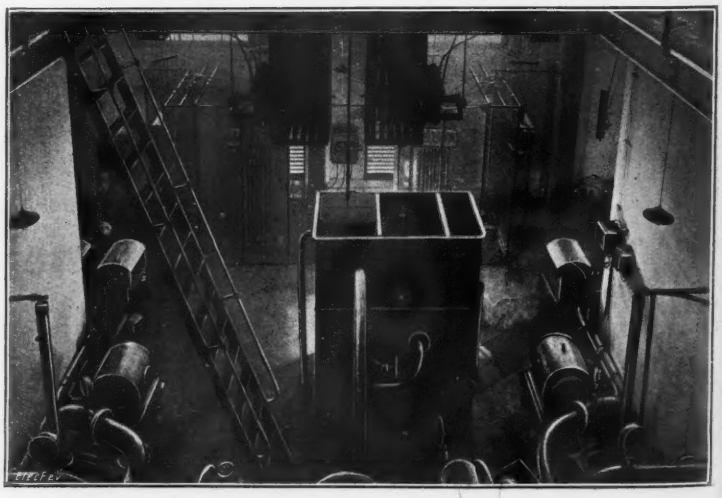
As to the cost of the new power supply scheme, the amounts sanctioned by the L.G.B. were £4,530 for buildings, £28,848 for plant and £3,766 for H.T. cables; further items of £500 for the extension of the battery room at the Burn Road station, and £4,151 for the provision of a Tudor battery of 300 KW. for three-hours capacity, booster, &c., were also sanctioned, and more recently an expenditure of £4,000 has been sanctioned on the new traction plant.

That the Corporation will gain largely by the new plant during the next few years can scarcely be doubted. For instance, the coal and water bills will disappear; the old station is non-condensing, and the last returns show an average consumption of 6½ lb. of coal per unit generated, and the price of coal has risen in a year from 9s. 7d. to 13s. 6d. per ton; the water bill at the old station was approximately £300 per annum. If one considers this in relation to the last published accounts (1911-12), when the total works, distribution, management, &c., costs amounted to £9,183 (on an output of 2½ million units), this amount —which we may assume to apply under the new conditions—will be reduced to £5,200, which, with a doubled output, represents roughly ¼d. per unit.

The position cannot, however, be gauged precisely at present, as, with the output probably doubled, production costs will be considerably reduced; on the other hand, the undertaking will lose the revenue from the supply to the Seaton Carew Ironworks, and have to meet extra capital charges due to the new plant.

The future, however, holds out a promise of a very considerably improved position of the electricity undertaking as compared with the past.

It may be interesting to note that power rates at West Hartlepool range from 2d. to 1d. per unit for small consumers, but in the case of large consumers the latter figure may be halved under suitable load conditions. A "restricted hour" power supply at £1 per quarter, plus ¾d. per unit has also proved very popular.



VIEW IN BASEMENT, SHOWING STATION TRANSFORMERS, SWITCHGEAR, HOTWELL AND RECORDER TANKS, &C.

Although one does not look for much electrical heating and cooking in the area, Mr. Friederichs offers a flat ½d. tariff for this, to consumers on ordinary lighting tariffs, with an alternative "domestic" tariff based on 10 to 15 per cent. of the rateable value, plus ½d. per unit; from which it will be seen that consumers are even now very favourably placed.

The contract for the whole of the plant at the new station was placed with Messrs. Richardsons, Westgarth & Co., the principal sub-contractors being Messrs. Siemens, the British Westinghouse Co. and Messrs. Reyrolle for the sections of plant mentioned.

In conclusion, we are indebted to Mr. H. F. Friederichs, the borough electrical engineer, for giving us every facility in connection with this article. For the scheme, which has been carried out under his supervision, Messrs. Tennant and Barrs, jointly with Mr. J. F. C. Snell, have acted as consulting engineers.

TELEGRAPH and TELEPHONE NOTES.

(*Concluded from page* 178.)

Imperial Wireless System.—In the House of Commons on Monday, Mr. H. Samuel stated that it had not been possible to publish the terms of the new Marconi contract, because a number of minor points were still unsettled. An alteration of considerable importance had been made in respect of the royalty to be paid to the company. The latter had found that in British East Africa, where the largest of the stations was to be erected, its inventions were not protected by patents; this station required six separate aerials, to communicate with Egypt, South Africa and India, and the company was not prepared to erect the installation if it were to receive no royalty for the use of its inventions there. The company had previously refused repeatedly to subdivide the royalty, and to allocate portions of it to different portions of the installation, but had now agreed to accept that condition provided that the royalties should be paid also in respect of the East African station. The contract would, therefore, provide that in lieu of a fixed payment of 10 per cent. royalty in respect of each station, 4 per cent. should be paid in respect of the internal transmitting apparatus, 2 per cent. in respect of the internal receiving apparatus, 2 per cent. in respect of the external transmitting apparatus, and 2 per cent. in respect of the external receiving apparatus. Thus, if in any one of these sections the Marconi apparatus were discarded, the royalty would be reduced to a corresponding extent, although the Marconi patents were still used in other sections of the station. By contracting for the erection of six stations instead of three, more favourable terms had been obtained than would otherwise have been possible, and delay had been avoided. The addition of a station at Hong-Kong had not yet been decided upon.

The Prime Minister stated that the debate on the contract would take place at the middle of next week.

In the course of a reply to letters in the *Times* written by Mr. Amery, the Postmaster-General denied a number of the statements of the former, and said that the agreement of 1909 for the purchase of the Marconi coast stations had no application whatever to the Imperial wireless chain. It was not true that Major O'Meara, when engineer-in-chief of the Post Office, was not consulted on the matter; Major O'Meara had attended a meeting of the Committee advising him on the subject, and had signed a memorandum relating to the necessity of actual tests before a tender from the Poulsen syndicate could be considered.

Referring to the letter from Sir Joseph Larmor, Mr. Samuel cordially approved of his views, and stated that he had already enlisted the assistance of Mr. Duddell for a period of years, on the recommendation of all his colleagues on Lord Parker's Advisory Committee, as well as of others, as the scientist best qualified to lead in such a task. With him would be associated the ablest of the engineers dealing with wireless telegraphy attached to the various Government departments. When occasion arose, a Committee, analogous to Lord Parker's, would be invited to meet to consider particular aspects of the problem. The letter concludes:—"The scientific man who regards the Imperial wireless stations from the standpoint of the theorist would wish them to be from the outset the perfect products of long and patient experiment. But the strategist says he must have them now. The Government is compelled to pay heed first to the strategist, while reserving full scope for the theorist as well. We go now to the contractors who have the experience, the designs, the staff to enable the stations to be quickly built. Once built, the Government takes complete control of them. It forms its technical committees; it trains its scientific staff; it places its new stations at their disposal for experiments; and it retains full liberty to replace whatever system is first installed by whatever better thing their later researches may discover or evolve."

In reply to questions in the House of Commons, Mr. Samuel stated that a distance of about 60 miles should be sufficient to prevent interference between neighbouring high-power stations. He would not consider applications for licences to private companies to carry on competing business on the Imperial wireless route within the next few weeks.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia. — Victoria. — September 9th. Common-multiple switchboard. See "Official Notices" to-day.

September 16th.—Switchboard, C.B. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

Queensland.—September 10th. Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

Austria.—August 8th. The authorities of the North-West Austrian Railway, in Vienna, are inviting tenders for an electric power installation, including a number of motors at the railway workshops at Ruriburg.

Vienna.—August 8th. Supply of electric transmission plant and motors in six lots, viz.:—(1) Chief and secondary distributing switchboards; (2) feed and distribution cables and lines; (3) seven 24-H.P. polyphase motors; (4) two 13-H.P. ditto; (5) one 8-H.P. ditto; (6) one 5-H.P. ditto. Particulars, Abteilung IV/4 der k.k. Nordwestbahndirektion, Vienna XX (enclosing postage and 2 kr.), and tenders to Einreichungs-protokol der k.k. Norwestbahn-direktion, Vienna.

August 11th.—Supply of telegraph apparatus for the years 1914, 1915, and 1916. Particulars free of the Post-Okonomieverwaltung, 17, Postgasse, Vienna I.

Trieste.—September 29th. Supply of an electrically-operated floating crane, with all accessories complete, including a Diesel electric plant. Particulars and forms from K. K. Lagerhäusern, in Trieste. Deposit 5 per cent.

Canberra.—September 1st. Commonwealth Department of Home Affairs. Switchgear for the power house at Canberra, the new Federal Capital in New South Wales. (1) Main power house switchgear; (2) Diesel engine switchgear. Tenders to the Secretary, Department of Home Affairs, Russell Street, Melbourne. Tenderers must state the earliest time of delivery. Deposit of 1 per cent. A copy of the specification, &c., together with a blue print, may be seen by United Kingdom manufacturers at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Belgium.—August 9th. The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine), are inviting tenders for the supply and laying of a quantity of telephone cable in the Namur district.

Brighouse.—August 9th. Cable and feeder pillars for the electricity department. See "Official Notices" to-day.

Bury. — August 25th. One 2,000/3,000-kw. turbo-alternator, with exciter and surface condenser, for the Corporation. See "Official Notices" to-day.

Canary Islands.—August 9th. The municipal authorities of Puerto de la Cruz (Canary Islands) are inviting tenders for the concession for the electric lighting of the town during a period of 21 years.

Dublin.—August 26th. Feed pump, cast-iron tanks, pipe work, valves, steam separators, boiler house shutters, coal grab and steel work, for the Corporation. See "Official Notices" to-day.

France.—August 23rd. The municipal authorities of Issoudun (Indre) are inviting tenders for the establishing of an electricity generating station for lighting and power purposes in that town.

Ilford.—August 11th. Motor tower wagon, for the U.D.C. Tramways Department. Mr. L. E. Harvey, tramways manager.

Italy.—August 13th. The Italian naval authorities at Spezia and Naples are inviting tenders for the supply of a quantity of electric wire and cables. The same authorities at Venice are also inviting tenders until the 19th inst. for a quantity of similar material

Littleborough (near Rochdale).—August 4th. Installation of electricity for lighting the Wesleyan Church, and also for organ power. Mr. E. G. Pearson, secretary, 89, Todmorden Road, Littleborough.

London.—Royal Mint.—August 12th. 200 tons of copper in ingots. See "Official Notices" to-day.

General Post Office.—September 1st. Stores Department (1) Supply of Swedish, Norwegian, Finland or Russian red fir telegraph poles; (2) creosoting, &c., telegraph poles. G. Morgan, Controller of Stores, 17-19, Bedford Street, W.C.

Newport (Mon.).—Re-winding 1,500-kw. three-phase alternator. Mr. A. N. Moore, electrical engineer, Town Hall.

New Zealand. — September 6th. Christchurch City Council. Thirteen-panel E.H.T. switchboard and accessories, for use in connection with the distribution in Christchurch of energy from the Lake Coleridge hydro-electric station. Specification (10s.) from City Electrical Engineer, 153, Gloucester Street, Christchurch. Deposit £50. Can be seen at B. of T. Com. Int. Dept., London.

Norwich.—August 12th. One 3,000-kw. turbo-alternator and surface condensing plant; rotary converters; E.H.T. switchgear for the Electricity Committee. See "Official Notices" July 18th.

Plymouth.—August 27th. Steam turbo-alternator, condenser, &c., for the Corporation. See "Official Notices" July 25th.

Roumania.—August 7th. Tenders are being invited by the municipal authorities of Ruschčii de Wede for the concession for the electric lighting of the town.

Shanghai.—August 26th. Two 5,000-KW. steam turbo-alternators, complete with surface-condensing plant; four water-tube boilers, with integral superheaters, mechanical stokers, economisers, &c., for the Municipal Council. See "Official Notices" July 25th.

South Africa.—September 10th. Public Works Department. Three electric bed lifts for the new hospital at Port Elizabeth. Particulars can be seen at Board of Trade Com. Int. Dept. in London, or obtained from District Engineers of Public Works Dept. at various places in South Africa.

BLOEMFONTEIN.—August 15th. Tenders for supply and equipment of electric tramways (railless) within the city, including poles, brackets, converting machines, switchboard, and 10 railless vehicles. Plans and specifications on payment of £5 at the offices of Messrs. Davis & Soper, 54, St. Mary Axe, London, E.C. See "Official Notices" July 25th.

Spain.—August 9th. The Spanish Ministry of Public Works in Madrid are inviting tenders for the concession for the construction and working of an electric tramway between Baeza and Linares.

Tenders have just been invited by the municipal authorities of San Bartolome de la Torre (province of Huelva) for the concession for the electric lighting of the town during a period of 20 years.

Spanish North Africa.—August 11th. The *Gaceta de Madrid*, of July 14th, contains a notice to the effect that tenders will be received at the offices of the General Directorate of Telegraphs in Madrid for the installation and working of an urban telephone system in Melilla.

Wakefield.—September 1st. Water-tube boiler, superheater, stoker, steam turbo-alternator, condensing plant, H. and L.T. switchgear for the Corporation. See "Official Notices" to-day.

Warrington.—August 6th. (1) E.H.T. feeder panel; (2) earthenware conduit for one year, for the Electricity Department. See "Official Notices" July 18th.

Wigan.—August 2nd. Best quick-firing slack and (or) washed peas for the electricity works during 12 months. Estimated 15,000 tons. Electrical Engineer, Bradford Place, Wigan.

CLOSED.

Atherton.—The U.D.C. has accepted the following tenders:—

T. Croft & Sons.—New sub-station.
General Electric Co.—Switchboards, &c.

Barnstaple.—The T.C. has accepted the tender of Messrs. Cory Bros., of Cardiff, for coal for the electricity works, at 18s. 6d. per ton for large, and 11s. 6d. per ton for small.

Belgium.—Four concerns submitted tenders to the municipal authorities of Farciennes (province of Hainaut) for the establishment of a central electric lighting station in the town, the lowest being that of the Société des Usines du Hainaut, of Couillet.

Bradford.—The T.C. has accepted the following offers to supply additional quantities of tramcar equipment at the same prices as in, and as an extension of, their present contracts:—

Siemens Bros. Dynamo Works, Ltd., 100 motors, 50 resistance sets, and 100 circuit-breakers
Hurst, Nelson & Co., Ltd., 50 trucks.
Dick, Kerr & Co., Ltd., 100 D.B. Form K4 controllers.

The tenders of Cole, Marchant & Morley, Ltd., and Collier Bros., Ltd., have also been accepted for the supply of 50 power brake sets, and for 30 miles of 0000 grooved copper trolley wire, at £2,698, respectively.

Canada.—WINNIPEG.—The Canadian *Electrical News* states that a contract has been awarded to Messrs. Vickers, Ltd., Montreal and Sheffield, for manufacture, delivery and erection of three 5,000-K.V.A. generators and auxiliary parts.

Croydon.—Tenders for the supply of coal to the electricity works have been accepted as follows:—

Cory Bros. & Co., Ltd.—250 tons of Tynebedw, at 28s. 9d. per ton.
Wm. Cory & Son, Ltd.—4,000 tons of Muirfield Peas, at 17s. 4d. per ton.
J. H. Gillman & Co.—250 tons of Mapperley Loco Hards, at 19s. 9d. per ton, 4,000 tons of Donisthorpe & Mapperley Nuts, at 18s. 6d. per ton.

The Education Committee has accepted the tenders of Mr. S. E. Hunt, at £90 and £75, for electrically lighting the Mitcham and Brighton Roads schools.

Derby.—The E.L. Committee of the T.C. has accepted the tender of Messrs. E. Morley & Sons, for the construction of turbine beds at £1,225; and the tenders of Mr. T. Walker, Parsons Bros., and Snape, Ltd., and the Derby Coal Co., Ltd., for coal for the electricity works.

The Tramways Committee has accepted the tender of Mr. G. F. Tomlinson, at £2,632, for doubling the tramway in Kedleston Road.

Doncaster.—The Tramways Committee has accepted the tender of Messrs. Arnold & Son, at £2,524, for extending the car shed in Greyfriars.

Eccles.—The tender of Mr. E. Beal has been accepted by the T.C., at £39 10s., for installing electric light at the Green Lanes Science School. The tenders of S. Hooley & Son have also been accepted for annual supplies of slack to the electricity works, at 11s. 3d. per ton; and best selected house coal at 19s. 7d. per ton.

Falkirk.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for A.C. meters.

Huddersfield.—The T.C. has accepted the tender of Messrs. J. Proctor, Ltd., for a coal elevator for the electricity works.

Hungary.—Messrs. Ganz & Co., of Budapest, have secured a contract for the construction and equipment of a system of electric tramways in the town of Funfkirchen.

Heston-Isleworth. — The Electricity Committee has accepted the tender of Messrs. W. Cory & Son, Ltd., for the supply of Bynteg anthracite coal for the year ending June 30th, 1914, at 20s. per ton, delivered at Brentford docks, G.W.R.

The National Boiler Insurance Co. having intimated that the economiser at the electricity works, in its present condition, is unfit for further use, the Electricity Committee has accepted the offer of Messrs. Green & Sons, Ltd., for supplying the necessary new tubes and superintending their erection, for the sum of £238.

Kingston-on-Thames.—The T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for coal for the electricity works.

Leyton.—The tenders received by the U.D.C. for electrically lighting the Church Road School were as follows:—

E. Beckwith & Co., Ltd.	£473
Boulting & Sons	588
C. H. Cathcart & Co.	555
J. T. Halsey (accepted)	376
Jordan & Plaford	541
Lund Bros. & Co.	567
Mackie & Co.	639
Private Telephone Co., Ltd.	499
"Ray" Electric Co.	547
Ryan & Son	425
M. Sims	435
Smeeton & Page	499

The Education Committee of the U.D.C. has accepted the tender of Mr. H. H. Taylor for installing the electric light at Goodall Road and Mayville Road Schools, at £44.

Rawtenstall.—Tenders are to be obtained for mechanical screens for the electricity works; a recorder is also to be obtained.

London.—L.C.C.—The tenders received for additional switchgear for the Shoreditch, Camberwell and Woolwich sub-stations and the central car repair depôt were as follows:—

Spagnoletti, Ltd. (recommended)	£1,000
Johnson & Phillips, Ltd.	1,068
Ferranti, Ltd.	1,100
Switchgear & Cowans, Ltd.	1,141
Eckstein, Heap & Co., Ltd.	1,331
A. Reyrolle & Co., Ltd.	1,388

Chief officer's estimate, £950.

The Fire Brigade Committee recommends that the offer of J. C. Braun, Premier-Werke A-G., Nurnberg, to supply a petrol-electric chassis for an escape van for £930 be accepted. The same firm will also deliver two petrol-electric chassis for fitting to Magirus ladders for £2,222, Messrs. Magirus, Ewald & Lieb, of Ulm, supplying two of their ladders for £1,300. The Committee is advised that "petrol-electric motor appliances suitable for the purposes of the Brigade cannot be obtained in this country."

The Highways Committee has received tenders for five miles of 0000 grooved trolley wire for the overhead system of tramways per mile, as follows:—

	£ s. d.
Thompson & Co. (French manufacture)	87 15 0
F. Smith & Co. (accepted)	93 6 8 (less 2½ per cent.) (£81 13s. 4d. per ton.)
B.I. and Helsby Cables, Ltd.	94 0 0 (less 2½ per cent.)
T. Bolton & Sons, Ltd.	91 13 0

The Highways Committee is to invite tenders from selected firms for rubber sheets, for use in connection with the tramways.

Tenders are also to be invited from selected firms for the provision of testing plant for polyphase electricity meters.

Six motor-cars are to be obtained for use in the tramways department, and tenders for the same are to be invited from selected firms.

It is proposed that a Sub-Committee of the Education Committee be empowered to open the tenders for installing electric lighting at four schools during the recess and to accept the lowest satisfactory one in each case.

The following tenders were received for the electric lighting installation at the new Hackney fire station:—

G. E. Taylor & Co. (recommended)	£162
Tredegar & Co.	196
H. J. Cash & Co., Ltd.	238
Finch & Wheeler, Ltd.	254
Cox-Walkers, Ltd.	357

Engineer's estimate, £197.

The tenders from selected firms for condensing water-pipes in the bed of the Thames at the Greenwich generating station are to be dealt with during the recess; also those for the switchgear required in connection with the new turbo-generators.

MARYLEBONE.—The following tenders have been accepted by the B.C. :—

Babcock & Wilcox, Ltd.—Four motor-driven fans, £1,588 (delivery to be made at the rate of about one a year).
J. P. Hall & Sons, Ltd.—Boiler feed pump, £219.
T. Press & Co.—Cleansing work at Rathbone Place sub-station, £79.
W. H. Allen, Son & Co., Ltd.—Duplicate armature to canal circulating pump motor, £222.

WOOLWICH.—The tender of the Sturtevant Engineering Co., Ltd., has been accepted by the Council at £188, for the supply of wet-air filters for filtration of the supply of air for ventilating the turbines at the electricity works. The derrick crane which has for the last six months been hired for work in connection with the erection of the Globe Lane electricity station is to be purchased from Messrs. Scott & Middleton, at £250, less the rent already paid.

HAMMERSMITH.—The B.C. Electricity Committee recommends for acceptance the tender of Messrs. Chamberlain & Hookham, Ltd., for two-rate meters. A time recorder is to be obtained from the International Time Recorder Co., for £35 10s.

Tenders are to be invited by the B.C. for the electric lighting of Uxbridge Road Tabernacle; also for a motor to be attached to the existing generator, to be supplied to Messrs. Gwynnes, Ltd., under their agreement with the Council.

Luton.—The Electricity Committee of the T.C. has accepted the following tenders for extensions at the works :—

W. Dunham & Sons, Luton.—Buildings, coal bunkers, &c., £8,566.
Babcock & Wilcox, Ltd.—Roofing steel work, £1 210.
Alphons Custodis Chimney Construction Co., Ltd.—Chimney, £1,290.
Clarke, Chapman & Co.—Two water tube boilers, £5,050.

Sevenoaks.—The Sevenoaks and District Electricity Co., Ltd., has entered into a contract with Messrs. Crompton & Co., Ltd., for the erection and equipment of a generating station, and to supply and lay about 22 miles of feeders and distributing mains, &c., at £29,730.

Southampton.—The T.C. has accepted the following tenders for annual supplies of coal to the electricity department :—

Bradbury, Son & Co., Ltd.—Newbury small coal, 13s. 9d. per ton.
Phœnix Wharf and Coal Co., Ltd.—Small coal, 15s. 9d. per ton.
J. R. Wood & Co., Ltd.—North Country small, 15s. 9d. per ton.
G. J. Eveson Coal and Coke Co., Ltd.—Ibstock small, 13s. 6d. per ton (subject to test).
Cory Bros. & Co., Ltd.—Scotch pearls, 14s. 9d. per ton.

Stoke-on-Trent.—The Electricity Committee of the T.C. has accepted the tenders from the following firms for coal :—

Sneyd Colliery, Ltd.—Cockshead slack.
Shelton Iron and Coal Co.—Great Row slack.
Bakewell and Butterworth.—Swadlincote nutty slack.
Mossfield Colliery Co., Ltd.—Slack.

Walsall.—The Electricity Committee of the T.C. has accepted the tender of the Harris Patent Feedwater Filter (1910), Ltd, for a water softener, at £345; and that of Messrs. Normans, of Wolverhampton, for a steel and iron boiler house at the generating station, at £397.

Willesden.—As a result of competitive trials just completed, an order for 67 long-burning flame arc lamps of the "Metroflam" magazine type, has been placed with Messrs. Johnson and Phillips, Ltd.

Repeat orders for lamps of this type have been placed during the month by the Newcastle Corporation, the Tyne Improvement Commission, and Messrs. Hawthorn, Leslie & Co., Ltd., Hebburn.

FORTHCOMING EVENTS.

North of England Institute of Mining and Mechanical Engineers.—Saturday, August 2nd. Annual general meeting, at 2 o'clock, at Wood Memorial Hall, Newcastle-on-Tyne. Paper open for discussion, "Lighting Efficiency of Safety Lamps," by Mr. T. A. Saint. To be read or taken as read :—"Notes on Coal-mining in the United States of America, with Special Reference to the Treatment of Coal-dust, and Haulage by Electric Locomotives," by Mr. S. Dean; "The Comparative Inflammability of Mixtures of Pit-gas and Air by Momentary Electric Arcs," by Prof. W. M. Thornton.

The Cruise of the "Alde."—The Batti-Wallabs' Society has, for the fourth time, had placed at its disposal by one of its past presidents—Mr. Riggs—his sailing barge *Alde*. The party going for the cruise this year is to be limited to 16. Comfortable cabin beds, electric light, and, to beat all, a complete range of electric cooking apparatus—what more can be desired, save good weather and ample provisions? The sailing day is to-day, and if what was the case a week ago is still true, there are yet a few vacancies, so interested parties had better get on to the 'phone straightaway ("Regent 3661," Mr. A. J. Greenly, entertainment secretary, 116, Charing Cross Road, W.C.). Batti-Wallah members can have the whole period of the cruise aboard from August 1st to August 11th for £3 10s., or they can spend a couple of week-ends with the party for, of course, a smaller sum.

Electric Vehicles in America.—The annual convention of the Electric Vehicle Association of America is to be held in Chicago on October 27th and 28th next.

NOTES.

Lead.—The market continues to show exceptional firmness, with a ready demand for all the metal coming in, and no important alteration in the broad outlines of the position. The scarcity remains, and everything arriving is immediately taken care of, though it must be admitted that there is not much new demand. This, however, is not to be looked for at the present very high range of values, which shows every indication of lasting for a long time yet. Even if the Mexican situation were straightened out at once, it would require some time for industrial affairs to settle down to approximately the normal, and meantime there would still be a shortage of material forthcoming. Prices can hardly go higher without more or less seriously interfering with the progress of consumption, indeed at to-day's level the manufacturer who would stock up, would be showing more hardiness than prudence, but really the position is one of exceeding gravity for users of the metal. It has been suggested that leading parties have been, and are still, holding back lead in Spain and Australia, but such statements entirely fail to reflect the truth, for abroad, as at home, there is nothing but scarcity to be met with. Prompt and near delivery metal is taken up with avidity by consumers, and now and again a little demand for forward metal asserts itself. The premium on near deliveries is still very noticeable, and this of itself tends to restrain new buying for far ahead, because consumers judge the position as none too good, when so large a difference as 20s. to 25s. exists between prompt and three months' ahead deliveries. On a broad view there is not yet any indication of a relaxation in the stringency being in sight.

Rings in Lead.—A German contemporary reports that a piece of lead pipe which had been buried, partially embedded in cement, for 24 years, showed, when cut, 24 red and 23 yellow oxide rings in that section which had been in the cement. The pipe which had been in the earth showed no such phenomenon. The two rings per annum were, doubtless, formed during the wet and dry seasons, the variation in moisture being responsible for the two degrees of oxidation. It would be interesting to hear whether a similar occurrence had been observed in lead-sheathed cables.

The "Paragon" System of Electrical Power Transmission.—On July 18th an application by the Maschinenfabrik Oerlikon for Letters Patent No. 19,890/1912 came before the Comptroller-General, in respect of opposition to the sealing of the same by Mr. William P. Durtnall, inventor and patentee of the "Paragon" system of ship propulsion and petroleum-electric railway traction. Mr. F. Bosshardt appeared for the applicants, and Mr. Durtnall handled his own case in person.

The invention sought to be patented related to improvements in driving electric locomotives, motor-boats and the like, wherein the driving shafts were to be rotated by means of polyphase alternating-current motors, supplied with current from polyphase alternating-current generators, which were to be carried on the vehicle and driven by steam engines, turbines, oil or gas engines. The speed was to be regulated by varying the speed of the prime mover.

Mr. Durtnall asked that the patent should be refused, and argued that anything not specifically mentioned in his specifications was either there by inference or was common knowledge, so that there was no subject matter in the applicants' specification that would justify the grant of letters patent.

The Comptroller-General's judgment was in Mr. Durtnall's favour with costs, as follows :—

"The Comptroller-General having given the matter his consideration, has come to the conclusion that he ought not to allow a grant in this case. The combination suggested by the applicants clearly embodies the opponent's combination; and the additional features suggested are apparently for the most part well known in themselves, and cannot be said to supply any patentable matter. In other words, the main principle of the combination has already been suggested by the opponent, and the other features relied upon constitute no inventive step. The patent must, therefore, be refused, and I award the opponent, Mr. William P. Durtnall, the sum of £3 3s. in respect of his costs, and direct the said sum to be paid by the applicants, Maschinenfabrik Oerlikon."

Colliery "Electricians."—A sequel to the incidents referred to in our issue of March 14th, page 418, came up at the Chesterfield Police Court on July 19th, when the manager of the Langwich Colliery was proceeded against by the Home Office, for various infringements of their regulations. After a prolonged hearing, the magistrates found no alternative to the infliction of a fine; and it is to be hoped for the benefit of all concerned in the industry that all responsible authorities at collieries will realise the necessity of securing properly qualified men for their electrical work. We recall that the electrician in this case who is, we see from the *Derbyshire Times*, no longer with the company, was under the impression that from four 100-volt lamps, arranged in series, the maximum pressure to earth was 100 volts and safe. He had had several years' experience, and was obviously of the class of wiremen who do things by rule of thumb, and have but the slightest, if any, theoretical knowledge.

Parliamentary.—VARIOUS BILLS.—In the House of Commons on July 22nd, the Lords' amendments to the Rhondda Tramways (Railless Traction) Bill were agreed to.

In the House of Commons on the 28th ult., the Central London Railway Bill and the Kent Electric Power Bill were read a third time.

American Electrical Developments at the Cauvery Falls, India.—An American Consul (Mr. H. D. Baker) on special service in India refers in a report, recently sent home to the States, to the extension works which are in progress in connection with the Cauvery Falls water-power undertaking in the native State of Mysore. From these falls 10,000 H.P. is at present being transmitted 92 miles to the Kolar gold fields, and about 2,000 H.P. somewhat lesser distances to the two cities of Bangalore and Mysore, where it is used for electric lighting and industrial purposes. The new extension will increase the water power available for the gold mines at Kolar by 7,000 H.P., and also will permit a fair increase in the power for use at factories in Bangalore. The original installation, which took place in 1900, cost £574,000, and the new electrical installation will cost £94,000. There is, however, to be a further large expenditure of about £534,000 on a huge dam and reservoir across the Cauvery River at the town of Kannambadi, about 15 miles distant from the City of Mysore. This is to be used both for increased water power and for irrigation. It is anticipated that its construction will not only ensure the steady supply of water the year round for power for industrial purposes and for existing irrigation in the Cauvery River valley, but it will also allow for an increasing power supply as future demands arise, and also for additional irrigation to the extent of 150,000 acres. The dam will have a total height of 124 ft. above the river bed when completed. The depth of storage will be 118 ft. There will be a canal on the north bank of the river about 100 miles long, capable of irrigating about 150,000 acres. The work will be constructed in two stages. In the first stage the dam will be raised to a height of 97 ft., so as to store a depth of 80 ft. of water, or 11,030 million cb. ft.

It appears that all the electrical equipment for the new installation is to be manufactured in the United States. A contract has been signed for the purchase of two 1,500-KW. generators and twenty 1,750-KW. high-voltage transformers, together with switchgear, to be supplied from Schenectady, at a cost of about £30,000. The Consul remarks: "Leading electrical firms in England and Germany bid competitively with American firms on this equipment, but the English bids were about 20 per cent. higher than the accepted bid of the American firm, and in the case of German firms their guarantees were not considered so satisfactory as those of the American firm. The new turbine installation, as in the original plant, will be from Zurich, Switzerland. In the new installation the voltage will be raised from 35,000 to 70,000 volts. An interesting feature of the new high-tension line installation will be the use of iron poles with cross-arms having porcelain insulators, which are to be supplied from Pittsburg, Pa., at a cost of £40,000. This iron-pole construction is deemed advantageous on account of the white ant difficulty with timber, and also because of local scarcity of tall enough trees for poles. The first Cauvery Falls water-power scheme was at the time of its inception one of the most important long-distance transmissions in the world, and attracted much special interest in the United States at the time, because it was one of the first notable instances of American manufacturers and American engineers participating so prominently in a great project so far from home. This scheme was originally carried out, and has always been subsequently managed, by American engineers appointed for this purpose by the Government of Mysore, and the electrical equipment which has always proved most satisfactory was all manufactured in the United States. The present electrical engineer in charge, who will also direct the new installation, is Mr. C. F. Beames, a citizen of New York State. Very brilliant financial results to the Mysore Government have followed this enterprising undertaking. The original capital outlay has now been practically all covered in subsequent profits. The plant is now netting in earnings about $500,000 a year, which is a substantial source of revenue. The charge to customers for power is about $50 per H.P. per year. A large augmentation of the profits is anticipated from the additional installation."

Sports.—The initial athletic gathering promoted by the London Electric Railways Association took place on the 26th ult. at Stamford Bridge Ground. A full list of winners appeared in the *Referee* on Sunday last.

Appointments Vacant.—Jointer for West Hartlepool electricity works; chief station superintendent for the new combined tramway and public power and lighting generating station, with outlying sub-stations in Perth, for the West Australian Government (£450); engineering clerk of works, for Rhondda U.D.C., Glamorganshire; two shift engineers (32s.), for Aberdare U.D.C.; electricity showroom assistant (£60), Ilford U.D.C.; engineer-in-charge at Darlington Corporation electricity works (£2, rise to £2 5s.); electrical engineer, for Postmaster-General's Department, for the State of Queensland (£528 to £600 per annum); assistant mains superintendent (35s.), and a junior shift engineer (25s.), for Southport; switchboard attendant for Lancaster (27s. 6d.). See our advertisement pages to-day.

Fatality.—A correspondent writes:—"A motor-lorry driver named Tom Roxborough (34), of Ravensthorpe, employed by Messrs. W. & R. K. Lee, doublers and spinners, Sowerby Bridge, met his death on Thursday last week whilst cleaning the boiler of his engine. He was working at the Mirfield Motor Wagon Works garage, by the light of a movable electric lamp of about 230 volts. It is believed he put his foot on a live wire, or that he came into contact with a "jack," which sent the current through his body and killed him almost immediately. He leaves a wife and five young children."

Windmills for Generating Electricity.—The principal component of a windmill is the wheel, the spindle of which is turned parallel to the direction of the prevailing wind (by a guide vane), in order that all blades may work uniformly. To avoid wasteful eddy currents, the blades should not be too close together, and should not extend to the centre of the wheel. The following table shows the horse-power which can theoretically be realised from a 28-ft. wheel exposed to winds of various velocities:—

Speed of wind, M.P.H.	H.P.	Speed of wind, M.P.H.	H.P.
2·25	0·04	22·5	40
6·7	1·1	33·5	135
11·2	5·0	45·0	520
15·7	13·0	67·0	1,080

The power available should increase with the cube of the wind velocity (since the kinetic energy of the air particles increases with the square of their velocity and the number of them striking the wheel blades per second increases in direct proportion to the wind velocity). It is not practicable to construct a mill which will utilise with equal efficiency a light breeze and a strong wind, hence the curvature and setting of the blades should be such that the mill works most efficiently when exposed to a wind of the velocity generally prevailing in the district concerned. If a wheel be designed to utilise with maximum efficiency a wind of 22·5 M.P.H., it will not run in a 7-M.P.H. breeze, since the power corresponding to this wind is less than the power required to overcome the light-load losses of the wheel and its gearing. Breezes of 8 to 15 M.P.H. are much more common than 20-M.P.H. winds, hence it is generally advisable to employ, for driving lighting or other dynamos, a very light wheel which will start work in a 3·5-M.P.H. wind, and which can still be used when the wind rises to 10 M.P.H. Such a wheel could not be exposed fully to a 30-M.P.H. wind, and for safety a device should be mounted on the main wheel, so that when the wind pressure exceeds a certain limit, the inclination of the blades is changed, against the control of a spring, in such a manner as to reduce the effective area exposed to the wind. The control springs may conveniently be set so that they come into operation when the wind velocity exceeds 16 M.P.H., and so that the output of the mill is constant in winds above 18 M.P.H.; there is thus secured maximum total annual output. Dynamos employed with windmills should not be excited from the battery, since the voltage of the latter may be very low after a long period of calm weather. The automatic main dynamo switch should operate when the machine voltage just equals that of the batteries, and mercury contacts should not be used.—*E.T.Z.*

A Useful Hint (from Glover's Almanac).—Among all the difficulties of getting old houses wired for electricity, the central station commercial man's problem really becomes acute when he tackles the rented dwelling. The tenant, of course, in most cases welcomes electric light, but the landlord usually remains obdurate when asked to invest from $25 to $75 additional in property from which he expects no increase of return. It was an astute contract agent who hit upon the scheme of getting the tenant's agreement to pay from 50 cents to $1 more per month, provided the landlord would wire the premises. With this offer cheerfully acquiesced in, the central station could approach the owner, showing him that the $6 to $12 yearly increase in rental allowed liberal interest on the small investment involved in the wiring, besides leaving a surplus to retire the principal in the course of a few years. The property was thus left with a permanent improvement, worth as a real estate increment several times the actual outlay, although acquired at no expense whatever to the owner.—*Electrical World.*

That Abominable Habit.—At the Bradford City Police Court on Tuesday last week, Ben Dickinson, of 482, Rooley Lane, Bradford, was summoned for spitting on a tramcar. Another passenger alleged that the defendant caused him annoyance through spitting on the floor, and upon his remonstrating with the defendant and drawing his attention to the by-laws of the Corporation he became very abusive. The defendant denied that he had been spitting on the car, but the conductor of the car stated that he saw marks of spitting on the floor by the defendant, and upon this a fine of 5s., including costs, was imposed. It was once the custom to put up a notice in American tramcars to the effect that "Those who expect to rate as gentlemen must not expectorate on the floor," and that "Passengers are requested not to spit; gentlemen won't!" Whether it be by pleasantries such as these or by the strong hand tramway authorities do well to try to stamp out this disgusting and dangerous habit.

Institution Note.—VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the meeting of this Institute held at Melbourne on June 26th, two 10-minute papers were read as follows:—"Tests on Fire-Resisting Materials," by Mr. Noel Murray; "Historical Electrical Progress in Victoria," by Mr. F. W. Chambers. Mr. W. J. Newbigin also delivered his Presidential address.

The Holidays.—The British Thomson-Houston Co.'s Works at Rugby will be closed from to-night until Tuesday morning, August 12th. The office staff will be in attendance as usual.

Inquiries.—Makers of electrically-heated case-hardening plants are asked for.

Educational Notes.—City and Guilds of London Institute.—The Council of the City and Guilds of London Institute has awarded the diploma of "Associate of the Institute" to the following matriculated third-year students who have completed a full course of instruction in electrical engineering:—E. A. Richards (Siemens Memorial Medal), R. S. H. Boulding (Siemens Memorial Medal), D. Dunham, G. J. Websdale, D. H. Linsley, N. H. Barker, U. Singh, L. B. Hobgen, L. G. Lloyd, H. B. Lee, A. G. C. Holroyde, V. H. G. Parker, J. C. Elmer, R. C. Wrinch, J. P. Clifton, H. A. Denison, W. Ryley, N. D. Edingborough, A. H. Hall, P. Jackson, H. Singh Siddhú.

An announcement respecting the electrical engineering courses at the University College, Nottingham, for next session, appears in our advertisement pages.

The Extraction of Atmospheric Nitrogen.—The International Nitrogen Co., of Wiesbaden, and the Nitric Acid Co., of Cologne, have disposed of their patents relating to the extraction of nitrogen from the atmosphere to the Electrochemical Industry Co., of Wiesbaden and Cologne. The former two companies have hitherto carried on works for the production of nitric acid at Patsch, near Innsbrück, where the local supply company furnished to them about 70,000,000 kw.-hours per annum at an exceptionally low price. As now taken over by the Electrochemical Industry Co., the Patsch works is to be used for the manufacture of calcium carbide and cyanamide, the plant to be capable of producing 8,000 tons per annum. Since this announcement was made in the second week of July, the International Nitrogen Co. has published its accounts for 1912 showing a loss of £4,700, and increasing the deficiency to £43,000. This fact probably explains the transfer of the undertaking to the company in question.

Electrical Anæsthesia.—The system of producing local anæsthesia with the electric current, devised by Prof. Leduc some years ago, has been developed and made suitable for ordinary applications. The apparatus was demonstrated last week at the laboratories of Messrs. W. Watson & Sons, Ltd., London.

Rifle Match.—On July 24th, the Siemens Dalston Works Miniature Rifle Club tried conclusions with the Poplar Electricity Works' team, who are members of the Electrical League, the result being a win for the Siemens team. The average score of the "drawn wires" was 95·5 out of a possible 100. Mr. Horace Bowden opened the shoot for Poplar and scored many bulls. The match was keenly contested, and a return match will be arranged.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Leicester T.C. decided on Tuesday to increase the salary of Mr. T. R. Smith, chief electrical engineer, from £600 a year to £700 with two further annual increments of £100 each.

The Erith U.D.C. has appointed Mr. Lionel H. Saynor, general assistant at the electricity works, to succeed Mr. R. N. Mayne as chief assistant electrical engineer at £160 per annum, rising by £20 a year to £200, which is to be the maximum.

Mr. James J. Murphy has been appointed electrical installation inspector under the municipal council at Shanghai, China. Prior to his departure for Shanghai, Mr. Murphy was presented with a dressing case by his friends at Ebbw Vale.

Mr. F. Selley, first-class assistant mains superintendent to the Marylebone undertaking, is to be promoted to chief assistant, at a salary of five guineas per week.

Mr. H. A. Harding, assistant mains engineer to the Metropolitan Electric Supply Co., Ltd., London, and formerly assistant electrical engineer to the Acton Council, has been appointed electrical engineer to the Bognor undertaking, under the Bognor Gas Light and Coke Co. His address is now: Electricity Works, Argyle Road, Bognor.

Mr. V. Goulding, senior shift engineer at the Heston and Isleworth Electricity Works, has resigned his position to take up an appointment at the Battersea Electricity Works. Before leaving Heston-Isleworth, Mr. Goulding was presented with a suit case by the staff, and the chief engineer, Mr. P. E. Rycroft, voiced their feelings by wishing him every success in his new position.

Mr. R. G. Barlow has been promoted to the position of second shift engineer at Heston-Isleworth electricity works, and his salary increased to £102 per annum; Mr. A. Sadler, an improver, has been appointed third engineer, at £78.

Mr. J. P. Rowell, switchboard attendant at the Lancaster Corporation Electricity Works, has been appointed charge engineer at the Bootle Electricity Works. Mr. Rowell is the third switchboard attendant from Lancaster who has obtained a post elsewhere during the past three months. Mr. R. T. Carleton was appointed to take charge of the plant at the Winter Gardens, Morecambe, in April, and Mr. W. G. Coates left to take charge of one of the sub-stations at Manchester in May.

General.—We learn with interest that Mr. E. P. Barfield, who has for the last six years rendered very active and enterprising service at Dalston, as manager to the incandescent lamp and fittings department of Messrs. Siemens Brothers Dynamo Works, Ltd., will be leaving that firm later in the year, in order to take up an important position which he has accepted with the Edison & Swan United Electric Light Co. Many of Mr. Barfield's friends in the electrical industry will recall that it was with the Ediswan Co. that he was connected at the outset of his career. Mr. Barfield has witnessed very large developments at Dalston during the period named above, and progressive schemes are still in hand. He has done a great deal to cultivate the social side of life, which means so much in connection with an industry of this character. We understand that he will not actually be leaving the Dalston works for some little time.

Prof. Wm. A. Bone, D.Sc., Ph.D., F.R.S., Professor of Chemical Technology, of the Imperial College of Technology, inventor of the Bonecourt system of flameless incandescent surface combustion, and technical adviser to Bonecourt Surface Combustion, Ltd., has been awarded by the Franklin Institute of Philadelphia, U.S.A., its Howard N. Potts gold medal for distinguished work in Science or the Mechanic Arts, in recognition of his work on "Surface Combustion," upon which subject he gave a lecture before the institute on October 30th, 1911.

The marriage has taken place at All Saint's Church, St. John's Wood, of Mr. Ernest Sydney Heurtley, M.I.E.E., and Miss Ena Mary Dent, daughter of the late Mr. Arthur Douglas Dent, and of Mrs. E. L. Swatman, of Sutton, Surrey.

Mr. A. A. Collie has severed his connection with the Sterling Telephone and Electric Co., Ltd., and joined the engineering staff of Marconi's Wireless Telegraph Co., Ltd. (Betulander Automatic Telephone system).

Will.—We read in the *Times* that the late Mr. James Watts Courtenay left estate of the gross value of £85,832; net personalty, £71,064.

NEW COMPANIES REGISTERED.

Central Argentine Light and Power Co., Ltd. (130,216).—Registered July 21st, by Charles Humphries & Co., 17-18, Basinghall Street, E.C. Capital, £100,000 in £1 shares. Objects: To generate, develop and accumulate electrical power at the Falls on the San Juan River, Province of San Juan, Argentine Republic, and elsewhere, to carry on the business of an electric light, power and supply company, and to adopt an agreement with the Isla Syndicate, Ltd. The signatories (with one share each) are:—C. W. Pearson, 3, London Wall Buildings, E.C. company secretary; H. Willinbrock, 64, Hamilton Road, Highbury Park, N., registrar: R. A. Cooke, 31, Lorne Road, Stroud Green, N., clerk; G. B. Winby, 7, Lawa Crescent, Kew Gardens, S.W., clerk; H. Read Smith, 3, London Wall Buildings, E.C., chartered secretary: H. J. Linford, 3, London Wall Buildings, E.C., company secretary, A. J. H. Angier, 121, St. Mary's Road, Ilford, shorthand writer. Minimum cash subscription, 10 shares; the directors are to number not less than three or more than seven; no persons had consented to act as directors to July 19th. Qualification, £250; remuneration, £200 each per annum (chairman, £250); secretary, H. Read Smith. Registered office, 3, London Wall Buildings, E.C.

C. R. Construction Co., Ltd. (130,287).—This company was registered on July 24th, with a capital £25,000 in 1,000 "A" ordinary shares of £1 each and 80,000 "B" ordinary shares of 1s. each, to carry on the business of constructors of public works and conveniences including railways and tramways in Argentina or elsewhere, and to adopt an agreement the parties to which are not named. The subscribers (with one ordinary "A" share each) are:—P. G. Thurston, 33, Fordel Road, Catford, S.E., solicitors' managing clerk; W. H. White, 48, Hibernia Road, Hounslow, clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Smiles & Co., 15, Bedford Row, W.C.

Lighting Press Syndicate, Ltd. (130,328).—This company was registered on July 25th, with a capital of £400 in £1 shares, to establish, print and publish the *Lighting Journal and Engineer*. The subscribers (with one share each) are:—A. W. Robinson, 116, Charing Cross Road, W.C., electrical engineer; A. J. Greenly, 116, Charing Cross Road, W.C., journalist. Private company. The number of directors is not to be less than two or more than three; the first are A. W. Robinson, A. J. Greenly and W. Riggs; remuneration, £25 per annum, divisible. Registered by Donald S. Ball, 167, Strand, W.C.

British Ljungstrom Turbine Co., Ltd. (130,312).—This company was registered on July 25th, with a capital of £25,000 in 10s. shares, to carry on the business indicated by the title, and to adopt agreements (1) with the Aktiebolaget Ljungstroms Angturbin and Wm. Beardmore & Co., Ltd., and (2) with Mr. R. S. Portheim. The subscribers (with one share each) are:—C. J. Lunn, 17, Townsend Road, South Tottenham, clerk; A. Hawthorn, 34, Marlowe Buildings, Calvert Avenue, Shoreditch, clerk. Private company. The number of directors is not to be less than two or more than three; the subscribers are to to appoint the first; qualification, £1,000; remuneration, £100 each per annum and a percentage of the profits. Registered by Nicholson, Graham & Jones, 24, Coleman Street, E.C.

Abcar, Ltd. (130,262).—This company was registered on July 23rd, with a capital of £5,000 in £1 shares, to manufacture and sell carbide of calcium and other similar products, &c., to acquire any invention relating to electricity, electro-chemicals and other electro products, &c. The subscribers (with one share each) are:—C. Bingham, 11 Queen Victoria Street, E.C., merchant; M. H. Thorp, Penshurst, Sheridan Road, Merton Park, articled clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first three; remuneration as fixed by the company. Registered office, Room 223, at 11, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Venner Time Switches, Ltd.—A memorandum of satisfaction to the further extent of £500 on July 1st, 1913, of debenture dated July 10th, 1911, securing £5,000, has been filed. (Previously paid off £500.)

Harvey Electro-Chemical Co., Ltd.—Debenture dated July 9th, 1913, to secure £1,000, charged on the company's uncalled capital. Holder: A. F. Forster, 28, Lincoln's Inn Fields, W.C.

James Keith & Blackman Co., Ltd.—Issue on July 21st, 1913, of £100 debentures, part of a series of which particulars have already been filed.

Reason Manufacturing Co., Ltd.—A memorandum of satisfaction to the further extent of £300 on December 1st, 1912, of mortgage dated May 1st, under an agreement dated January 15th, 1900, securing £1,200.

Babcock & Wilcox, Ltd. (65,805).—Capital, £1,760,000 in 100,000 pref. and 1,660,000 ord. shares of £1 each. Return dated May 8th, filed June 21st, 1913. All shares taken up; £360,000 paid on 360,000 ord.; £1,400,000 considered as paid on 100,000 pref. and 1,300,000 ord. Mortgages and charges: Nil.

Musselburgh and District Electric Light and Traction Co., Ltd.—A memorandum of satisfaction to the extent of £500 on July 22nd, 1913, of charges dated November 13th, 1905, and May 11th, 1909, securing £90,000, has been filed.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 25th, 1913. 23,620 shares taken up; £236,000 paid. Mortgages and charges: £3,000.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated May 15th (filed June 19th, 1913). 6,500 shares taken up; £61,000 paid on 6,100; £4,000 considered as paid on 400 shares. Mortgages and charges: £50,000.

CITY NOTES.

Brush Electrical Engineering Co., Ltd.

THE directors' report for the year ended December 31st, 1912, states that although the volume of business has been maintained, a proportion of the contracts on which the company has been engaged were entered into in previous years and at the low prices which then ruled. This circumstance, coupled with the serious effects of the coal strike and of other strikes in the steel industry which occurred in the spring of the year, and the consequent general advance of the cost of materials, have adversely affected the year's operations, and the directors regret that their expectations of improved results have not yet been realised. The largely increased cost of insurance under the Workmen's Compensation Act and under the new National Health and Unemployment Acts has also been an adverse factor. As proposed in the last annual report, a committee representing the shareholders and other interests was formed to consider the scheme of reduction of capital and for raising fresh capital which had been prepared by the directors. Several conferences took place between the directors and this committee, and at a meeting held on September 26th, 1912, the following resolution was unanimously passed:—

> The Committee having heard the explanations of the directors and considered various schemes for dealing with the situation, are of opinion that the scheme submitted by the directors for reduction of capital and for raising additional capital is, as amended by the Committee, the most suitable proposal for carrying on the company, and should be recommended for adoption.

An issue was accordingly made of £86,620 (part of £100,000) prior lien second debenture stock, which was offered to the first and second debenture-holders and to the preference and ordinary shareholders. Of this amount, £39,743 was taken up, and a further amount of £11,300 was subsequently placed, also at par, making a total of £51,043 allotted. The scheme for reduction of the share capital to deal with the accumulated balance to debit of the profit and loss account, is delayed pending the completion of the accounts for the current year. The company has acquired a licence to manufacture the Ljungström steam turbine, which promises remarkable economies in steam consumption, and for which a large demand is anticipated. The first set of this type is now in successful operation at the Willesden power house of the North Metropolitan Electric Power Supply Co. The sum of £7,675 was expended during the year on new machine tools, for the purpose of enlarging the company's manufacturing facilities on the engineering side. These tools were of types requiring special construction, and the delay thereby involved only allowed of partial advantage being derived from them during the period covered by the accounts. The contracts in hand have been secured at more satisfactory prices, and, given a period reasonably free from labour troubles, the outlook is now more favourable. During the year opportunities have occurred, and been utilised, of realising at a profit some of the securities held by the company.

The twenty-fourth ordinary general meeting was held on Wednesday at Electrical Federation Offices, Kingsway, W.C., Mr. Emil Garcke presiding.

The CHAIRMAN, in proposing the adoption of the above report, said that at the last meeting he stated that the progress which they were making towards a better state of things, although slow was nevertheless very clear and definite, and that their loss on trading had been gradually reduced from £40,000 in 1908 to under £6,000 in 1911. He also expressed the hope that the accounts for 1912 would, at any rate, show an equilibrium between profits and expenses, including all the debenture interest and other charges, and the directors therefore considered that the time was opportune for carrying out the long delayed reorganisation of the capital account. The balance-sheet then presented was made up with a view to showing what, in the opinion of the directors, should be the reduction of capital, and they recommended that a committee of shareholders and representatives of debenture-holders should be appointed to confer with the directors on the scheme of reorganisation and on the position of the company generally. All the gentlemen who had volunteered to serve on such a committee were accordingly appointed, several conferences took place between the committee and the directors, and, finally, a resolution was unanimously adopted in which the committee expressed the opinion that the scheme submitted by the directors, as amended by the committee, was the most suitable proposal for carrying on the company. Accordingly, a circular was issued last October to the shareholders and debenture-holders, in which the whole position was explained, and an offer was made of £86,000 of prior lien participating second debenture stock, part of £100,000. The share and debenture-holders took up their *pro rata* allotments to the extent of £39,743, and a further amount of £11,300 was subsequently placed, also at par, making a total of £51,013 allotted. The circular also stated that the scheme approved by the Committee provided for the reduction of the share capital of the company, as suggested in the last annual report, and stated that, after the new stock had been issued, the directors would call extraordinary general meetings of the shareholders to consider, and if deemed advisable, to proceed with the reduction of capital. Owing, however, to the time taken up by the negotiations for placing the new debenture stock, the end of the year was reached before the whole of the £51,000 debenture stock was allotted, and, therefore, the directors felt that it would be better to postpone proceeding with the application to the Courts for sanction to reduce the capital. There was no object to be gained by effecting a reduction of capital until they were in a position to make profits, and had the prospect of being able to pay dividends upon the reduced capital, and although they might seem to be slow in attaining that position, they were nevertheless making decided progress in that direction. Having expressed the thanks of the directors to the Committee of Shareholders for their help in placing the affairs of the company on a better basis, Mr. Garcke said that dealing with the balance-sheet, there was an increase in the figures on each side over the figures of 1911 of about £16,400. The expenses were about £4,700 more than in 1911, but that was not surprising, considering that the output from the works was much larger. Indeed, the amount of work in hand at the end of the year was larger than it had been for several years. The increases in the expenses applied to many of the heads, but were not large in any of them. Salaries were £1,326 up; law expenses were £356 up, insurances were £1,100 higher, and they spent £1,184 more on the maintenance of plant and buildings. Debenture and other interest was £1,300 higher. On the other hand, directors' fees were £150 down. Advertising expenses were £1,150 less, and they had saved £237 on their expenses at the old Victoria works. The credit side of the profit and loss account showed that the profit on trading was £3,867 less than in the preceding year, but the profit on sale of shares was £6,519 more than in the preceding year, and they showed a net loss for the year of £7,700 as against a loss of £5,700 in 1911. He was very sorry that their expectations of being able to show at least an equilibrium between the expenses and the receipts, were not realised in the past year, but the result, though regrettable, was unavoidable. Having referred to the serious effect which the coal strike had had on the business during the year, he said he was glad to say that during the current year they had been free from labour troubles in their particular business, though there still continued to be a good deal of unrest amongst workmen engaged in the engineering industries. In their business, it was especially of importance that they should be able to carry on in harmony with their workmen and without the harassment of labour disputes. Many of their contracts took months, and, in some cases, even years to finish; and as the prices had to be fixed at the time the orders were booked, it was manifestly essential that they should be in a position to carry out those contracts at the same wages as ruled at the time they were entered into, otherwise all calculations might be upset, and business, which showed a fair margin on the estimates, might end up on the wrong side. To protect themselves as far as possible against those dangers, they had latterly endeavoured to make agreements with the Trades Union, by which the district rates for the different classes of labour they employed were settled, to stand for a definite period without modification up or down, and he was glad to testify to the fact that those agreements, when made, were loyally and honourably observed by their workpeople. Speaking generally, the contracts now on their books had been secured at more favourable prices. There was a better feeling among the manufacturers engaged in the industry, and the tendency which was so noticeable a year back for competing firms to take work at prices showing the barest margin of profit was gradually disappearing. It was, however, only right to point out that better prices brought with them one serious drawback—he referred to the increase of foreign competition. So long as home manufacturers were willing to accept contracts at unremunerative prices, this market had no attraction for the foreigner, except in particular cases where some special object was to be served by "dumping," but directly prices stiffened sufficiently to show a fair profit, the competition from abroad became active, so that what they gained in one direction they were liable to lose in another. Foreign competition in electrical engineering work was very real and serious and could not be measured by the amount of the imports alone. At previous meetings he had referred to their work as builders of turbo-generating plant, and he was pleased to say that in this department they had well maintained their reputation. In pursuance of their policy to keep thoroughly abreast of the latest improvements in steam turbines they had identified themselves with the Ljungström turbine. That was a Swedish invention which had been very carefully worked out and tested before being put on the market. It was original in design, strongly protected by patents, and promised great economy in steam consumption, a feature of importance for situations where coal was high in price. The

first set of this type—a turbo-alternator of 1,500 H.P. capacity, was started to work a couple of months ago at the Willesden power house of the North Metropolitan Electric Supply Co. where it was in successful daily operation under full service conditions. They had orders in hand, and in immediate prospect for these machines, and were looking forward to a large demand for turbines of this size. They built great hopes on the development of this new turbine, for ever since he had acted as chairman of the company, he had been endeavouring to find some branch of manufacture in which they could specialise with a view to producing a standard output. That was not easy in the present condition of the electrical industry in this country, and he was very glad, therefore, that they were able to take up the manufacture of a machine which was fully protected by patents, which was cheap to manufacture, and which possessed merits in advance of other machines in the market, and, moreover, which was within the capacity of the company's works to make on commercial lines. On the rolling stock side they had, beside the usual standard lines of tramcars and trucks, railway passenger coaches and wagons, turned out considerable numbers of motor-omnibus bodies of different types, principally for service in the Metropolitan area. Practically the whole of the bodies on the blue M.E.T. omnibuses on the London streets were of their make. That was a line of manufacture for which they were especially well equipped, and in which they hoped to continue to do good business. The volume of all orders secured during this year had so far been well maintained. As he had already said, they were getting better prices, and concurrently they were making special efforts to keep their works' expenses down. This was the fourth year in succession he had appeared before them as chairman. When, in 1909, he accepted the position, he did so without any illusions as to the nature of the difficulties to be encountered and the responsibility of the position. But he thought that it would be only for a year or two, for the purpose of assisting to carry out a much needed rearrangement of capital—he had no idea that the work was so uphill and that progress would be so slow. If they re-elected him that day, he proposed to hold the position for another year, and if by then the situation had not materially improved, he thought it would be right that he should give someone with fresh energies, and perhaps greater resources, an opportunity of retrieving the fortunes of the company. Meanwhile, they thought it might be advisable to try the experiment of appointing one or two additional directors who had influences of a kind that would be useful to the company and who might be able to help to improve the position. On that occasion they proposed the election as a director of Mr. Spagnoletti, who had been connected with the industry for many years, and who had expressed his willingness to lend them a helping hand.

Mr. B. S. Broadhurst, the managing director, seconded the motion.

Mr. Marchmont pointed out that this year, taking into account the profit of £6,519 realised on the sale of shares, the company had made a loss of £7,700. That meant to say that without that profit on shares, which would not be available another year, they would have made a loss of £14,000. Under these circumstances, he asked the directors what prospect there was of the company doing better next year. He thought the time had come when the whole position ought to be seriously grappled with. If it was not done to-day, it would have to be done next year, and he could see no good in putting the matter off.

Mr. Bush said the chairman talked about "hoping" that things would be better, but hope would not make a business, or bring customers or profit. It seemed to him that the position wanted to be tackled in a very serious way, for there was a business with a capital of about three-quarters of a million of money, which really showed a loss of about £15,000. Unless something was done soon, bankruptcy stared them in the face.

Mr. Grey said he would like to know whether other companies were in a similar position. He believed that, speaking generally, electrical engineering companies were doing fairly well. Of course there was competition, but he believed that prices were improving, and he should have thought the Brush Co. was in a position to compete with anyone who came along. He did not see what they could do, unless they wound up.

Mr. Green suggested that it might be possible to amalgamate with other similar concerns, by which a large saving might be effected in administration expenses, and the closing down of some of the works.

The Chairman, in reply, said he did not wonder that the shareholders were dissatisfied. It was exceedingly disappointing that they should be doing all this hard, good, genuine work, and not be able to show any result to the shareholders. The directors quite appreciated that they could not bring the company round simply by "hoping." That would be a very foolish policy to pursue, and the figures as to the turnover showed that they relied on something much more than bare hopes—they were putting life and blood and tissue into the concern in a manner that very few who were not engaged in similar businesses could have any idea of. If they were in any other country the same amount of energy that they were using would produce gigantic results. The Committee which met the directors came to the conclusion that nothing more could be done than the directors were doing—that was to keep on struggling. That was all they could do except commit suicide by going into bankruptcy, and he did not see that that would put the shareholders or the debenture-holders into any better position. If the company was unsuccessful it was not because of unsuccessful management. If they were the only company manufacturing electrical apparatus in this country showing poor results, it would be a very bad inference indeed that there was something wrong with the management, but the facts were that they could look round amongst the various electrical manufacturers in the country and they would find evidence of intense struggle, and of enormous effort and exertion without corresponding result. There were two or three companies that were paying moderate dividends, but nothing whatever in proportion to the work they did, or to the high skill brought to bear, and the sacrifices that they had made in the past, but the large majority of electrical manufacturing businesses in this country were no better than they were. The suggestion of amalgamation was one that was worth considering, but it was not always possible by putting two or three losing companies together to produce one successful concern.

The report was then adopted.

The chairman was re-elected on the board, and Mr. Spagnoletti was elected as a director.

Monterey Railway, Light and Power Co.—The directors' report for 1912, states that, notwithstanding the unfortunate political situation which continues to exist, and the consequent general commercial depression prevalent throughout the country, the balance-sheet shows a satisfactory increase of gross and net earnings in all departments. The financial result of the year's operations are summarised as follows:—Gross income, $518,428; less interest on debenture stock, $292,743; leaving $225,684. The dividend on the preference stock absorbed $25,000, the surplus being consequently $200,684. This result, produced under unusual conditions, is gratifying, but it is not due to any general enlargement of the company's operations, nor to the new business which naturally follows the normal increase of population and commercial expansion of a prosperous community. The year has not offered attractive opportunities for expansion of operations or for the investment of new capital, beyond expenditures necessary to protect the interests of the company under the several State concessions. The directors, however, believe that with a return of normal commercial conditions throughout the Republic a general expansion of the company's business would result, with a corresponding increase of earnings.—*Financial Times.*

Continental.—France.—A new company has just been formed at Ressons-sur-Matz, with the title La Société du Secteur Electrique de la Vallée du Matz, to establish a small central electric lighting station in the district.

La Société des Acieries Electriques d'Aiguebelle is the name of a new company which has lately been formed at Aiguebelle (Savoy) with a capital of £50,000, to put down a plant to utilise the water power of the River Roche near that town, and to equip works for the production of steel by the Chaplet electrical process.

Russia.—A company is in course of formation in St. Petersburg with a capital of 1,000,000 roubles, and the title the Baltic Co. of Electrical Undertakings, for the establishment of an electricity generating station on the banks of the River Aa in Liflande.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1913, at the rate of 5 per cent. per annum (the same as in 1912), carrying forward on the six months' trading £17,747 as compared with £13,614 last year. Warrants will be posted on August 15th. On the City undertaking, after providing for debenture interest and dividend on the preference shares, £10,401 is carried forward as compared with £5,388 last year.

Compania de Electricidad de La Provincia de Buenos Aires, Ltd.—An extraordinary general meeting will be held at Capel House, New Broad Street, London, on Saturday, August 2nd, for the purpose of passing resolutions increasing the capital £1,100,000 by the creation of 25,000 addition shares of £4 each, and extending the directors' powers of borrowing and raising money by £200,000 beyond the limit fixed.

Stock Exchange Notice.—The committee has ordered the under-mentioned securities to be quoted in the Official List:—

Automatic Telephone Manufacturing Co., Ltd.—360,000 Ordinary shares of £1 each, fully paid, Nos. 1 to 360,000.

Metropolitan Electric Supply Co., Ltd.—The directors have declared an interim dividend for the half-year ended June 30th last at the rate of 4 per cent. per annum, payable August 13th. This is the same rate as paid in 1912.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the four weeks ended June 27th, 1913, amounted to 1,053,088, compared with 1,012,739 units in the corresponding four weeks of 1912.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors announce an interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the past half-year. The rate in 1912 was the same.

Metropolitan Railway Co.—The directors announce an interim dividend on the ordinary stock for the past half-year at the rate of 1½ per cent. per annum, leaving a balance of £4,773.

Chelsea Electricity Supply Co., Ltd.—The directors announce an interim dividend at the rate of 4 per cent. per annum, less income-tax, on the ordinary shares for the half-year. The 1912 interim dividend was at the same rate.

Westminster Electric Supply Corporation, Ltd.—Interim dividend for the half-year at the rate of 10 per cent. per annum on the ordinary shares, as compared with 9 per cent. paid last year.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange markets have not yet drifted into their usual August condition of placidity. There is a fair amount of business going on—patchy, of course, but still providing a certain amount of work for the House as a whole. The principal feature is activity of American Rails, reflected in a mild manner by some of the telegraph shares. Business in Marconis has fallen away to something of a flicker; but, on the other hand, there is a good deal of interest in most of the Mexican securities.

The Home Railway market received a much-needed fillip by three or four unexpectedly good dividend announcements, which came to counteract the unfavourable effect produced by the Great Eastern and South-Eastern declarations. Thanks to this, the market recovered its previous losses, though the Undergrounds remain dullish. The absence of accounts and meetings in respect of the first half of the year has placed an unexpected restraint upon the public attention usually paid to Home Railways during July and August; and most of the financial critics are urging strongly the desirability of the companies issuing some kind of financial statement by way of showing how they stand, up to the end of the first six months.

Metropolitan stock went back to 45½ upon the dividend declaration, at the rate of 1½ per cent., though this, as a matter of fact, was equal to market anticipations. Districts keep about 33, and no further changes have occurred in the Central London group beyond a point rise in the Deferred Assented stock. London United Tramways Debenture stock continues to droop, and is now no better than 56. This is due in some measure to the success of the 'buses over the trams. As it was pointed out a fortnight ago in this journal, the unfair conditions under which the trams are labouring, as compared with the 'bus companies, are exciting comment. Even those who do not love the trams acknowledge that the hardship of the competition may lead to the whole question being ventilated by local bodies before long.

Electric Lighting shares are extremely quiescent. The prospectus has been circulated of the Sevenoaks and District Electricity Company, Ltd., an undertaking with a capital of £40,000, in shares of £1 each. The prospectus states that a contract has been entered into with Cromptons, Ltd., under which they undertake to erect and equip the generating station, to supply and lay out 22 miles of feeders and distributing mains, and to do other necessary work, for the lump sum of £29,730 1s. 6d., payable in cash.

The activity in Yankees alluded to above has caused rises in American Telephone and Telegraph stock and Collateral Trust bonds, Anglo-American Preferred, Direct United States shares, New York Telephone bonds, and West India and Panama Ordinary shares, the improvements ranging from $\frac{1}{16}$ to a point. The rise in Direct United States shares is 7s. 6d. West India and Panama Second Preference fell ⅛ to 9⅝, and Commercial Cable Debenture is ¼ down. Great Northern Telegraphs eased off to 30½, and Mackays are a little lower. In the Eastern group the more pacific news from China encouraged improvements in Eastern Ordinary, which went up 1½, and in Eastern Extensions, which gained ½. Westerns are 2s. 6d. higher. Globe Preference eased off to 12.

Marconis, as a group, are weak, the report of the Spanish and General Company causing pronounced disappointment. The price of the Spanish shares dropped to 7s. 6d., being rather nominal even at that; while Canadians dwindled to 8s. 6d., and Americans to 15s. 6d. The parent company's shares shed 5s., the delay in the announcement of the dividend leading to uneasiness, although in explanation of this it was rumoured that the company desired to fix up the new contract with the Government before declaring its dividend and issuing the report. The proposed terms of that new contract made the dull market rather duller. National Telephone Deferred moved languidly between 27¾ and 28½; a further return of capital is to be made immediately.

The Mexican Utility division fell into further depression, owing to dramatic falls in the prices of some of the country's railroad bonds, these ranging from 2 to 10 points during the week. In some of them smart recoveries ensued, and thereupon the market for the utility issues firmed up a little. It cannot be said, however, that there is any too much confidence felt at present with reference to these; and on the week, Mexico Trams show falls of 2 to 3 points, the company's Common shares having shed the latter amount and standing now at 87½.

Mexican Light and Power descriptions are steady. Rio Trams and Sao Paulo Trams have both risen ½, but Brazil Tractions at 86½ are 1½ down. Anglo-Argentines are better, although the only quotable change is a rise of ½ in the 5 per cent. Debenture stock. Southern Electric of Buenos Ayres 5 per cent. Debenture stock gained a point to 98. City of Buenos Ayres Trams rose to 5$\frac{7}{16}$. The British Columbia stocks have held their rises, and the 4½ per cent. Debenture stock is ¼ higher. Canadian General Electric Common eased off to 109. Georgia Light and Power shares have been moving quickly and erratically.

Manufacturing issues show no special changes, beyond a rise of 10s. in Telegraph Constructions to 36. British Westinghouse 4 per cent. Debenture is 2 points down; Henley's Debenture hardened to 101.

The continued rise in the price of copper has imparted pronounced strength to most of the Copper Mining shares, the movement in the metal being engineered very largely from New York. Rubber shares remain dull, the various proposals for re-establishing the price of the commodity being at present too vague to influence either rubber or rubber shares. What speculative interest exists just now is being devoted mainly to the steadily rising oil share market.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, July 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£6 5	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£17 10	..
a Copper Sulphate	,,	£21 10	10s. inc.
a Lead, Nitrate	,,	£27 10	..
a ,, White Sugar	,,	£26	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	85/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£8 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£95	..
b ,, Wire, in ton lots (1 to 14 S.W.G.)	,,	£121 6 8	..
b ,, Sheet, in ton lots	,,	£126	..
p Babbitt's metal ingots	,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	⅛d. dec.
c ,, Tube (brazed)	,,	8¼d.	1d. dec.
c ,, ,, (solid drawn)	,,	7⅞d.	1d. dec.
c ,, Wire, basis	,,	7⅛d.	⅛d. dec.
c Copper Tubes (brazed)	,,	10⅜d.	⅛d. dec.
c ,, ,, (solid drawn)	,,	10½d.	⅛d. dec.
g ,, Bars (best selected)	per ton	£84	£1 inc.
g ,, Sheet	,,	£84	£1 inc.
g ,, Rod	,,	£84	£1 inc.
d ,, (Electrolytic) Bars	,,	£66 10	..
d ,, ,, Sheets	,,	£84 10	..
d ,, ,, Rods	,,	£72	..
d ,, ,, H.C. Wire	per lb.	8½d.	..
f Ebonite Rod	,,	4/6	..
f ,, Sheet	,,	4/-	..
n German Silver Wire	,,	1/10	..
h Gutta-percha, fine	,,	7/- to 8/-	..
h India-rubber, Para fine	,,	8/9	1d. dec.
l Iron Pig (Cleveland warrants)	per ton	55/3	8½d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£21 5 to £21 10	inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 5	..
e Mica (in original cases) small	per lb.	6d. to 3s.	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	,,	3/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods	,,	1/0½ to 1/5	..
p ,, ,, rolled strip & sheet	,,	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£184 to £185	£2 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/6	..
p White Anti-friction Metals	per ton	£50 to £228	..
k Zinc, Sh's (Vieille Montagne bnd.)	,,	£25	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
k Bolling & Lowe.
l Morris Ashby, Ltd.
m Richard Johnson & Nephew, Ltd.
n W. T. Glover & Co., Ltd.
o P. Ormiston & Sons
p Johnson, Matthey & Co., Ltd.
r W. F. Dennis & Co.

Japan.—The Tamagawa Electric Tramway Co. reports a net profit of £2,161 for the last financial half year. After paying the dividend on the preference shares £847 is being carried forward.

The Tokio Narita Electric Tramway Co. reports a net profit of £3,221 for the last financial year; a dividend of 5 per cent. is being declared.

County of London Electric Supply Co., Ltd.—The directors announce an interim dividend on the ordinary shares for the half-year ended June 30th, at the rate of 5 per cent. per annum, less tax. Last year the interim dividend was at the rate of 4 per cent.

National Telephone Co., Ltd. (In Liquidation).—It was announced that a further distribution, equal to 22 per cent. (4s. 4·8d. in the £), was to be made on Wednesday, the 30th ult., to the deferred stockholders whose names appeared on the registers of the company when finally closed on February 25th last.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 29th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	6	9⅞ — 10⅛	..	5 14 3
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅛	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10⅛ — 10⅜	..	5 12 11
Do. 4½ % Deb. Stock	Stock	4½	4½	94 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅛	..	5 9 7
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8⅜	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅛ — 4⅜	..	5 5 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8½ — 4	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	8	9	14½ — 16	..	5 12 6
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	98 —100	..	4 10 0
County of London, Ord.	10	6	6	10⅝ — 11⅛	+ ⅛	5 7 10
Do. 6 % Pref.	10	6	6	11¼ — 11⅜	..	5 2 2
Do. 4½ % Deb.	Stock	4½	4½	102 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	Nil	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	6	4 — 4⅛ xd	..	3 8 7
Do. 6% Non-Cum. Pref.	5	..	..	1⅞ — 2⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	9†	7⅞ — 8⅛	+ ⅛	5 9 1
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 7⅝	..	5 16 2
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	8	2½	2½	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	4	4†	8¼ — 8⅝	..	5 10 4
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	77 — £0	—1½	4 7 6
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9½ — 10½	..	5 14 3
Oxford	5	7½	6†	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8⅝ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5	5½	2⅞ — 3⅛	..	7 7 8
Do. 5 % First Mort. Deb.	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 10 6
Urban, Ord.	£3	Nil	Nil	¾ — ⅞	..	..
Do. 5 % Cum. Pref.	5	2	3	2⅜ — 2⅞	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8 — 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5⅛	..	5 14 3
Calcutta, Ord.	5	8½	8½	7 — 7⅛	..	5 13 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com.	$100	7	7	107 —111	—1	6 6 2
Do. 7 % Pref.	$100	7	7	118 —123	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	3	5	⅝ — ⅞	..	6 8 1
Do. 5 % Deb.	100	5	5	94 — 95½	..	5 4 9
Elec. Lt. and P. of Coohabamba, 6 % Bonds	100	6	6	90 — 92	..	6 10 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	1	6	6	11/16 — 13/16	..	9 12 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99½ —101½	+ ½	4 18 6
Madras, Ord.	5	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	74 — 77	..	6 9 10
Mexican Lt. & Power, Common	$100	4	4†	57 — 61 xd	..	6 11 2
Do. 7 % Cum. Pref.	$100	7	7	92 — 97	..	7 4 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	86 — 89	—1	5 12 4
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	76 — 79 xd	..	6 6 7
Montreal, Lt., H. and Power	$100	8	9†	210 —220	..	4 1 10
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	10	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	5	5½	124 —128	+1	4 5 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½ —106½	..	4 14 0
Do. 4½ % Per. Deb.	Stock	4½	4½	99 —102	..	4 8 8
Toronto Power, 4½ % Deb.	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	9⅞ — 9½	..	5 8 1
Victoria Falls Power, Pref.	1	11¾d.	17½d.	11/16 — 12/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	93½ — 95½	..	5 4 9
American Telep. & Teleg., Cap.	$100	8	8	130 —133	+1	6 0 4
Do. Collat. Trust	$1000	4	4	90½ — 92½	+ ½	4 6 6
Anglo-American Telegraph	Stock	8	8	60 — 63 xd	..	4 15 3
Do. 6 % Pref.	Do.	6	6	108 —109	+ ½	5 10 1
Do. Def.	Do.	80/-	80/-	28½ — 29⅜	..	6 6 4
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104 —106	..	4 15 3
Chili Telephone	5	7	8	7⅜ — 7 13/16	..	5 2 5
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	82½ — 84½	— ½	4 14 8
Cuba Telegraph	10	6	6	8¾ — 9½	..	6 6 4
Do. 10 % Pref.	10	10	10	15½ — 16½	..	5 19 4
Direct Spanish Telegraph, Ord.	5	4	4†	8¼ — 8½	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6½ — 7½	..	6 12 0
Direct United States Cable	10	5	4	6⅜ — 7⅛	+ ⅛	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	126 —129	+1½	5 8 6
Do. 5½ % Pref. Stock	Do.	5½	5½	74 — 76 xd	+ ½	4 12 1
Do. 4 % Mort. Deb.	Do.	4	4	92 — 94	..	4 5 1
Eastern Extension	10	7	7	12 — 12½	+ ⅛	5 10 2
Do. 4 % Deb.	Stock	4	4	92 — 94	+1	4 5 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	10⅝ — 11⅛	..	5 8 9
Do. 6 % Pref.	10	6	6	11½ — 12½	— ⅛	4 18 0
Great Northern Telegraph	10	18	20	29½ — 31½	— ½	6 7 10
Indo-European Telegraph	25	13	13	55 — 57	..	5 14 0
Mackay Companies Common	$100	5	5	79 — 81	—1½	6 8 5
Do. 4 % Cum. Pref.	$100	4	4	66 — 70	..	5 14 4
Marconi's Wireless Telegraph	1	20	..	3⅜ — 3½	— ⅛	5 14 3
Do. 7½% Cum. Partic. Pref.	1	17	..	2⅞ — 3	— ⅛	5 13 4
Monte Video Telephone, Ord.	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	2/32 — 3/32	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	98⅞ — 99⅞	+ ⅛	4 10 3
Oriental Telep. and Elec.	1	8	10	12⅜ — 13⅞	..	5 8 6
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1½	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86½ — 88½	— ½	4 10 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	..	4 1 8
Reuter's	10	10	10	8⅞ — 9⅜	..	10 5 2
Submarine Cables Trust	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	8†	6⅛ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1⅛ — 1⅜	..	4 8 4
Do. 4 % Debs., 1 to 1,600 guar. by Bras. Sub. Tel.	100	4	4	93 — 96	..	4 1 8
West India and Panama Teleg.	10	1½	1½	2⅛ — 2⅜	+ 1/16	4 17 6
Do. 6 % Cum. 1st Pref.	10	6	6	9½ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 9⅝	— ⅛	6 1 6
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd.	10	7	7†	12½ — 13	+ ⅛	5 7 8
Do. 4 % Deb.	Stock	4	4	90½ — 92½	..	4 6 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	90 — 93	..	4 16 9

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 29th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5	2 — 2	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	72 — 77	..	5 17 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	8 — 10	..	..
Do. Do. Deferred	100	..	..	3¼ — 5½	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	78 — 81	..	7 8 2
Do. 7 % Non-Cum. Pr'f.	100	..	3	38 — 41	..	7 6 4
Do. 5 % Perp. Deb.	100	5	5	90 — 93	..	5 7 6
Do. 4½ % 2nd Deb.	100	4½	4½	73 — 77	..	5 17 0
Central London Railway, Ord.	100	3	3	75 — 77	..	3 18 0
Do. Gtd. Assented	100	..	..	80 — 82	..	4 18 9
Do. Pref.	100	4	4	80 — 82	..	4 17 7
Do. Gtd. Assented	100	..	..	82 — 84	..	4 15 3
Do. Def.	100	2	2	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	..	78 — 80	+1	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99 xd	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	101 —103	..	4 17 1
Do. Do. 1898	100	5	5	100 —102	..	4 18 0
Do. Do. 1901	100	5	5	99 —102	..	4 18 0
Do. Do. 1903	100	5	5	99 —102	..	4 18 0
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼ — 2¾	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	1⅞ — 2⅛	..	7 13 7
Do. 4½ % Deb.	100	4½	4½	68 — 73	..	6 8 3
sle of Thanet Trams, 5 % Pref.	5	2½	2½	2¼ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	76 — 78	..	6 8 2
London and Suburban, Ord.	1	..	..	⅜ — ½	..	..
Do. Do. 5 % Cum. Pref.	1	..	..	⅛ — ⅜	..	..
Do. Do. 4½ % 1st. Deb.	100	..	4½	65 — 75	..	6 0 0

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations July 29th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
London Elec. Railw'ys, 4 % Deb.	100		4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	54 — 58	−2	6 15 7
Metropolitan Railway Consol.	100	1⅞	1⅝	45½ — 45⅞	— ½	3 11 0
Do. Surplus Lands	100	2½	2½	61 — 63	..	4 7 4
Do. 3½ % Deb.	100	3½	3½	83 — 85 xd	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	78 — 80	..	4 6 5
Metropolitan District Ord.	100	Nil	Nil	32¾ — 33½	..	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 85	..	5 5 11
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	..	5 2 3
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	4½	3½	⅝ — ¾	..	..
Do. 5 % Pref.	1	6	5	⅞ — 1	..	7 5 6
Do. 4½ % Deb.	100	4	4½	82 — 85	..	5 6 0
South Metro. Trams, 6 % Pref.	1	..	..	¾ — ⅞	..	8 0 0
Do. 4 % Deb.	100	..	4	63 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	8⅜ — 8⅝	..	Nil
Do. "A"	1/-	4½	..	⅜ — ½	..	Nil
Do. 6% First Cum. Inc. Deb.	100	1½	6	109 —111	+1	5 8 1
Do. 4½ % Bonds	100	Nil	4½	98 —100	..	4 10 0
Do. 6 % Income	100	3	6†	90 — 91	+ ½	6 11 10
Yorkshire (West Riding), Ord.	5	..	..	1 — 2	..	Nil
Do. 6 % Pref.	5	..	3†	3½ — 3¾	..	3 18 8
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅜ — 5	..	5 10 0
Do. 2nd Pref.	5	6½	6½	4⅞ — 4⅞	..	6 3 11
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	94½ — 96½	..	4 13 3
Do. 5 % Deb.	100	5	5	96½ — 98½	+ ½	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	99 —101	..	4 19 0
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	85½—87½	+1½	6 17 2
Brisbane Trams Invt., Ord.	5	8	8	6¾ — 7⅜	..	5 8 6
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	128 —132	..	6 5 0
Do. Pref. Ord.	100	6	6	112 —117	+1	5 2 7
Do. 5 % Pref.	100	5	5	102½ —105½ xd	..	4 14 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102 xd	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	96½— 97½	+ ⅛	4 7 2
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 14 3
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 18 9
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Cape Electric Trams	1	2½	5	1⅛ — 1⅜	..	6 3 1
City Buenos Aires Trams (1904)	5	5	5†	5 1/16 — 5 1/16	+ 1/16	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	⅛ — ⅜	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 5 % B Deb.	100	6	3	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	⅛ — ⅜	..	..
Do. Pref.	1	6	..	1⅝ — 1⅞	..	5 16 6
Lisbon Elec. Trams, Ord.	1	6	4½d.	1⅛ — 1⅜	..	4 9 3
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	..	6	4⅞ — 5⅛	..	5 17 1
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	86½ — 89½	−1	5 11 9
Manila Elec. R. and Lig., Bonds	$1000	5	5	99 — 101	..	4 19 0
Mexico Trams Com.	$100	7	7†	86 — 89 xd	−8	7 17 4
Do. Gen. Con. 5 % Bonds	..	5	5	87 — 90	−2	5 11 1
Do. 6 % Bonds	100	6	6	85 — 88	−2	6 16 4
Para Elec. Rlys. & Lt., Ord.	5	10	10	6 — 6½	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅝ — 5	..	6 0 0
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1¼ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	98½ —100½	+1½	4 19 6
Do. 5 % Mort. Bonds	100	5	5	92 — 94	+ ½	5 6 5
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	99½ — 101½	+ ½	4 18 6
Singapore Trams, 5 % Deb.	100	5	5	85 — 89	+ ½	5 12 4
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅞	..	7 8 7
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 9

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	⅞ — 1 xd	..	7 7 8
Do. 6 % Pref.	1	6	6	1 1/32 — 1 3/32 xd	..	7 2 6
Babcock & Wilcox	1	28	16	2⅜ — 3⅛	..	5 5 7
Do. Pref.	1	6	6	1⅞ — 1⅞	..	4 7 8
British Aluminium, Ord.	1	Nil	..	⅞ — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	6	⅞ — 1	..	5 17 2
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 4 2
Do. Deb. Stk.	100	5	5	83 — 86	..	5 16 3
B.I. & Helsby Cables	5	10	10	7½ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅜	..	4 14 1
Do. Deb.	100	4½	4½	99 —102	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	97 — 99	..	4 11 0
British Westinghouse, Pref.	8	Nil	Nil	⅛ — ¼	..	Nil
Do. Deb.	100	4	4	62 — 66	−2	6 1 3
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	3/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	88 — 48	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 13 4
Callender's Cable	5	15	15	10⅜ — 11⅜	..	6 11 10
Do. Pref.	5	5	5	4 1/32 — 5 1/32	..	4 18 9
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Castner-Kellner	1	20	20	31 — 32	..	5 6 8
Do. Deb.	100	4½	4½	103 —106	..	4 4 11

Crompton & Co.	..	..	..	.. — ..	..	..
Do. Deb.	100	5	5	54½ — 59½	..	8 8 0
Dick, Kerr	1	5	Nil	⅝ — ¾	..	..
Do. Pref.	1	6	6	15/16 — 1	..	7 18 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	1/4 — 1/2	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	65 — 70	..	7 2 10
Electric Construction	2	3½	5	1½ — 1⅝	..	7 5 6
Do. Pref.	2	7	7	1⅞ — 2⅛	..	6 11 9
Greenwood & Bailey, Pref.	10	7	7	7⅜ — 8	..	8 5 8
Do. Deb.	100	5	6	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	5	6	9½ — 10½	..	5 14 3
Do. Deb.	100	4	4	89 — 94	..	4 5 1
Henley's, Ord.	5	15	15	12 — 12½	..	5 17 8
Do. Pref.	5	4½	4½	4½ — 5	..	4 10 0
Do. Deb.	100	4½	4½	100 —102	+ ½	4 8 3
India-Rubber, G. & T.	10	..	7½	11½ — 12½	..	6 2 5
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	20	35 — 37 xd	+ ½	6 7 2
Do. Deb.	100	4	4	95 — 97	..	4 2 6
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	⅛ — ¼	..	Nil
Do. Deb.	100	4	4	55 — 57	..	7 0 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

TRADE STATISTICS OF JAPAN, 1912.

The following statement, showing the imports into and exports from Japan of electrical and similar goods during the year 1912, is taken from the recently issued official trade statistics; the figures for 1911 are given for purposes of comparison, and notes of any increases or decreases are added :—

	1911. Yen.	1912. Yen.	Inc. or dec. Yen.
Galvanised iron wire.—			
From Great Britain ...	109,000	370,000	+ 261,000
„ Germany	1,963,000	2,385,000	+ 422,000
„ Belgium	67,000	125,000	+ 58,000
„ Austria	11,000	9,000	— 2,000
„ United States ...	179,000	608,000	+ 429,000
„ Other countries ...	13,000	2,000	— 11,000
Total ...	2,342,000	3,499,000	+1,157,000
Rails.—			
From Great Britain ...	229,000	137,000	— 92,000
„ Germany	1,837,000	671,000	—1,166,000
„ Belgium	216,000	575,000	+ 359,000
„ United States ...	3,220,000	2,475,000	— 745 000
„ Other countries ...	2,000	81,000	+ 79,000
Total ...	5,504,000	3,939,000	—1,565,000
Posts for electric wire materials for building, &c.—			
From Great Britain ...	719,000	505,000	— 214,000
„ Germany	205,000	383,000	+ 178,000
„ United States ...	1,138,000	1,174,000	+ 36,000
„ Other countries ...	58,000	85,000	+ 27,000
Total ...	2,120,000	2,147,000	+ 27,000
Submarine and underground cables.—			
From Great Britain ...	179,000	203,000	+ 24,000
„ Germany	197,000	3,000	— 194,000
Total ...	376,000	206,000	— 170,000
Insulated electric wire.—			
From Great Britain ...	1,490,000	2,622,000	+1,132,000
„ France	66,000	15,000	— 51,000
„ Germany	1,758,000	2,485,000	+ 727,000
„ Italy	85,000	4,000	— 81,000
„ United States ...	297,000	261,000	— 36,000
„ Other countries ...	4,000	1,000	— 3,000
Total ...	3,700,000	5,388,000	+1,688,000
Parts of electric cars.—			
From Great Britain ...	199,000	Not	—
„ Germany	496,000	shown	—
„ United States ...	764,000	separately.	—
Total ...	1,459,000		
Steam engines.—			
From Great Britain ...	364,000	218,000	— 146,000
„ Germany	60,000	45,000	— 15,000
„ United States ...	123,000	98,000	— 25,000
Total ...	547,000	361,000	— 186,000
Gas engines, petroleum engines and hot-air engines.—			
From Great Britain ...	758,000	989,000	+ 231,000
„ Germany	237,000	167,000	— 70,000
„ Belgium	—	7,000	+ 7,000
„ Sweden	49,000	114,000	+ 65,000
„ United States ...	32,000	55,000	+ 23 000
„ France	33,000	52,000	+ 19,000
„ Other countries ...	—	6,000	+ 6,000
Total ...	1,109,000	1,390,000	+ 281,000
Steam boilers.—			
From Great Britain ...	1,465,000	1,000,000	— 465,000
„ Germany	27,000	89,000	+ 62,000
„ United States ...	185,000	86,000	— 99,000
„ Other countries ...	1,000	—	— 1,000
Total ...	1,678,000	1,175,000	— 503,000
Water turbines and Pelton wheels.—			
From Great Britain ...	Not	59,000	—
„ Germany		790,000	—
„ France	shown	7,000	—
„ Switzerland ...		15,000	—
„ Sweden	separately	7,000	—
„ Other countries ...		3,000	—
Total ...		881,000	
Dynamos, electric motors, &c.—			
From Great Britain ...	745,000	1,323,000	+ 578,000
„ Germany	1,407,000	1,199,000	— 208,000
„ Italy	—	2,000	+ 2,000
„ Switzerland ...	16,000	7,000	— 9,000
„ United States ...	943,000	1,605,000	+ 662,000
„ Other countries ...	3,000	5,000	+ 2,000
Total ...	3,114,000	4,141,000	+1,027,000
Wattmeters.—			
From Great Britain ...	Not	188,000	—
„ Germany	shown	189,000	—
„ United States ...	separately	147,000	—
Total ...		524,000	
Cranes.—			
From Great Britain ...	394,000	738,000	+ 344,000
„ Germany	46,000	53,000	+ 7,000
„ United States ...	136,000	110,000	— 26,000
„ Other countries ...	2,000	8,000	+ 6,000
Total ...	578,000	909,000	+ 331,000
India-rubber and gutta-percha, crude.—			
From British India ...	237,000	282,000	+ 45,000
„ Straits Settlements	1,383,000	1,642,000	+ 259,000
„ Dutch India ...	161,000	146,000	— 15,000
„ Great Britain ...	935,000	461,000	— 474,000
„ Germany	7,000	39,000	+ 32,000
„ United States ...	253,000	321,000	+ 68,000
„ Other countries ...	84,000	138,000	+ 54,000
Total ...	3,060,000	3,029,000	— 31,000

The exports of electric machines and parts thereof from Japan in the years 1911 and 1912 were as follows :—

To China	161,000	171,000	+ 10,000
„ Kwantung Province ...	145,000	101,000	— 44,000
„ Philippine Islands ...	3,000	7,000	+ 4,000
„ Siam	4,000	1,000	— 3,000
„ Australia	3,000	4,000	+ 1,000
„ Hong Kong	34,000	28,000	— 6,000
„ British India	7,000	14,000	+ 7,000
„ Straits Settlements ...	7,000	5,000	— 2,000
„ United States	5,000	2,000	— 3,000
„ Other countries ...	9,000	7,000	— 2,000
Total ...	378,000	340,000	— 38,000

Yen = 2s. ½d.

American Patent Law.—The Electric Club, of Chicago, recently appointed a Committee on Patent Legislation, consisting of seven members (with Mr. M. G. Lloyd as chairman). This Committee has studied the proposals for legislation now before Congress and has unanimously recommended that Congress be urged to provide for a commission to be made up of independent non-partisan men of national reputation, chosen from different walks of life, including representatives of inventors, manufacturers, patent lawyers, the Federal Courts and the general public, to thoroughly study and investigate all phases of the American patent system and its needs for betterment and the operation of patent systems in other countries, and that no legislation be passed until such commission has reported its findings to Congress. The Committee holds that such legislation when enacted should include changes in the administration of the Patent Office which will permit of more thorough work and result in the recognised validity of any patent issued by it until the same has been declared invalid by a Patent Court; and it favours the creation of a Court of Patent Appeals to have final jurisdiction in all patent cases. It strongly disapproves of both form and substance of the Oldfield Bill, and would regard its enactment as highly prejudicial to the interests of both inventors and the general public, except that the provision limiting the duration of a patent to 19 years from the date of application is approved.

The Activity of the Berlin A.E.G.—The directors of the A.E.G., reporting on the position of business on July 15th, state that notwithstanding the decline in a number of industries through the general condition of trade, the company's degree of activity shows a large increase. For the first 10 months of the past financial year the figures concerning the invoiced turnover and the orders on hand exceed in value those for the corresponding period of the previous year by over £4,500,000, and the liquid assets are completely sufficient for the monetary requirements devolving upon the company. A Berlin newspaper points out in this connection that the statement does not contain any special expression respecting future developments, and that it is difficult to form an opinion on the question, as sales and orders are combined, so that it is uncertain how much of the £4,500,000 applies to unfilled contracts and how much to orders already completed

SILITE AND ITS USES IN SCIENCE AND INDUSTRY.

[BY OUR BERLIN CORRESPONDENT.]

Carborundum or silicon carbide,* which, in 1893, was first produced in the electric furnace by Acheson, has an hexagonal crystalline structure of remarkable hardness, and cannot be melted at ordinary pressures. Attempts have been made to utilise it for the manufacture of electric heaters (rods, tubes, &c.), and for many other purposes in connection with which the silicon carbide must be reduced into the form of shaped solid objects. This, however, proved impossible unless considerable amounts of binding

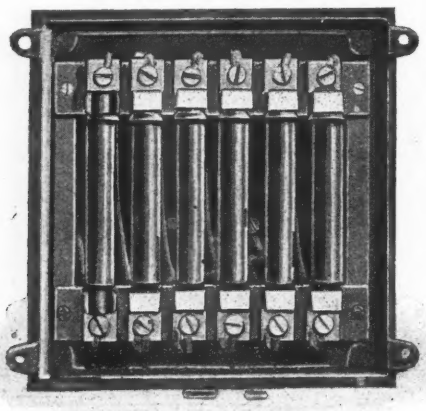


Fig. 1.—Compact Rheostat with Silite Rods.

materials, such as clay, were used to keep the carborundum powder together, thus increasing the porosity of the material, impairing its solidity and reducing the electrical conductivity to a minimum.

The problem of producing out of silicon carbide rods, tubes and other shaped objects possessing not only a satisfactory electrical conductivity, but, at the same time, high density, strength and mechanical resistance to chemical agents and high temperatures, was first solved in 1904, in a process patented by Messrs. Siemens Bros. & Co., of Berlin-Lichtenberg, by adding free silicon to the silicon carbide, mixing the two substances as intimately as possible, and shaping them as desired. The binding matter used in this connection may be volatile or carbonisable, when the carbon precipitated combines on heating with the silicon contained in the material. Though binding materials eventually remaining in the shaped object can likewise be used, they are, of course, less desirable. After shaping the material, it is preferably heated intensely

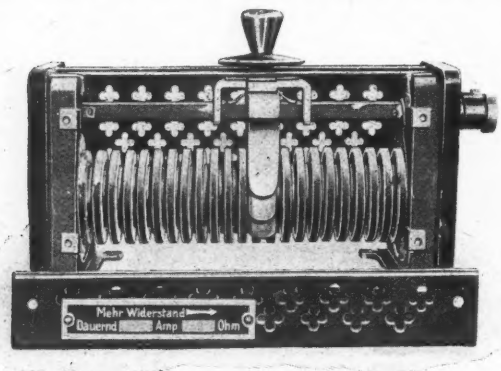


Fig. 2.—Silite Slide Rheostat.

n the electric furnace to the temperature at which a non-porous body as homogeneous as possible will be formed.

Messrs. Siemens Bros. & Co.'s process is presumably based on the fact that silicon carbide with silicon forms a carbide of a lower order. This hypothesis is mainly borne out by the physical condition of any objects thus obtained, which seem to be perfectly homogeneous and of a crystalline structure entirely different from the initial material.

Further progress in the same field was made in the following year (1905). By heating the objects shaped and compressed from silicon and silicon carbide in an atmosphere of nitrogen, the silicon was made to absorb nitrogen while forming silicon nitride to bind the silicon carbide into a material of extraordinary density and solidity.

The electrical heaters thus produced, however, showed the disadvantage of a gradual variation in electrical resistance when continually exposed at glowing temperature to the open air. This drawback was eventually eliminated in a process patented by Dr. Egly, which allows heaters consisting exclusively of silicon carbide to be obtained. These possess a remarkable electrical conductivity, and on account of their mechanical, thermal and chemical strength, are particularly well adapted for the purposes of electric heating. As shown by numerous tests made at Messrs. Siemens' works, they will stand even the most sudden variations in temperature without suffering any damage ; objects manufactured by this

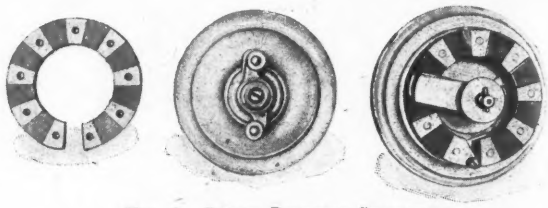


Fig. 3.—Silite Dimming Switch.

process can, for instance, be drenched with water when at a bright red heat without showing cracks, fissures or any other damage.

Messrs. Siemens Bros. & Co. have now taken up, on a commercial scale, the manufacture of all sorts of solid silicon carbide objects, which are brought out under the designation of "silite."

Silite is a material which combines two qualities of the highest importance for technical purposes, viz., a satisfactory electrical conductivity coupled with a high heat resistance. Silite objects can be mainly subdivided into three groups destined for different purposes, viz. :—

Group 1.—Silite as electrical resistance material for permanent loads at incandescence temperatures, especially for high momentary loads.

Group 2.—Silite for heaters to be exposed to permanent incandescence temperatures.

Group 3.—Silite as fire-proof material readily standing any sudden change in temperature.

The scope of silite objects belonging to Group 1 has of late increased beyond any expectations. Wire resistances, as previously used, are replaced more and more by silite resistances for excess voltage cut-outs, lightning arresters, slide switches, &c. Regulating and starting resistances of any kind are made of silite in the form of rings, rods, tubes, &c., in fact, the most diverse forms and approximately for any resistance desired, the specific resistance of silite objects being readily varied within wide limits. The temperature coefficient of silite is negative, the more so as the specific resistance at normal temperature is higher. Apart from the chemical and physical superiority of silite as compared with wire resistances, its low space requirements are to be noted. In

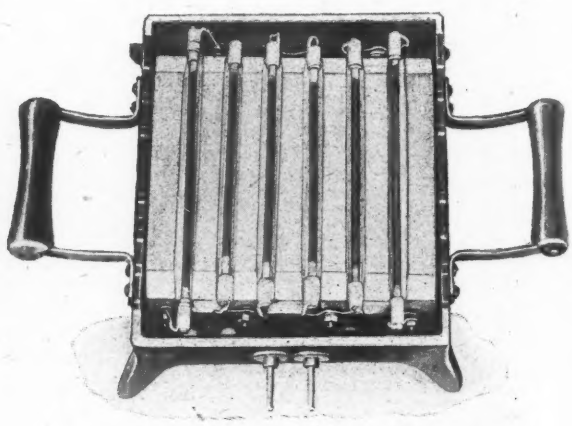


Fig. 4.—Silite Hot-plate with Top Removed.

fact, silite resistances hardly take up a quarter of the space occupied by wire resistances. This point is of especial importance for many installations in industrial works, on board ship, &c.

In order to be able to control electric lamps in dwelling-houses like gas flames, from full brightness gradually down to a feeble glimmer, switches comprising silite segments are used, which can be operated by any unskilled person.

Silite objects of Group 2 are preferably used for heating, standing as they do incandescence temperatures of 1,200-1,400° C. The specific resistance of this group varies between 3,000 and 900 at normal temperatures and between 1,000 and 4,000 at temperatures of 1,000 to 1,200° C. and upwards. From 900 to 1,000° C. the specific resistance undergoes practically no variation, a fact of the highest importance in connection with silite heaters. Silite

* See also "Silundum," Electrical Review, December 18th, 1908, p. 1070.

objects of Group 2 have given excellent results as dish-heaters, heating and chafing plates, grills, toasters, heating cabinets, cigar lighters, curling-iron heaters, &c. In the electric kitchen, silite apparatus are used just like gas or coal ranges over which they possess the advantage of absolute safety and greater cleanliness. Combined heating plates, with two heating positions, are especially suitable for private kitchens.

Silite heaters are frames into which the silite elements are inserted in parallel or series connection; in the former case the sides of the frame at the same time serve as current conductors, thus forming a large radiating surface which, as soon as the current has been switched on, gives off its heat to the surroundings. Parallel connection affords the advantage of allowing the load

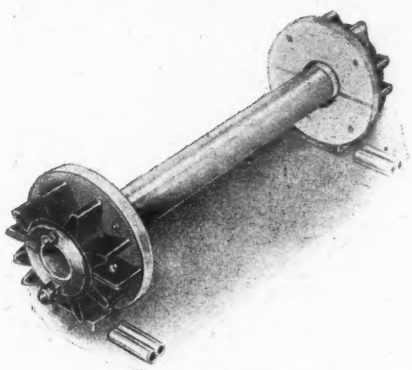


Fig. 5.—Silite Heating Tube.

on each element to be so chosen as to make it insensitive to fluctuations in voltage. As the mass of the silite elements and furnaces is reduced to a minimum, they do not accumulate any superfluous heat.

Being also designed in the form of heating tubes up to about 75 mm. in clear width, silite is exceedingly well adapted for the annealing of wires, *e.g.*, tungsten wires, to be used as metal filaments for incandescent lamps and for the manufacture of hardening furnaces for the most diverse kinds of steel in instrument making, &c. The silite material of Group 2 is very easy to work, and is readily filed, sawed, bored, &c.

Silite objects of Group 3, besides being used as electrical conductors for loads below incandescence temperature, mainly serve as fireproof bodies, which can be readily exposed to sudden changes in temperature. Such silite conductors, on account of their excellent thermal conductivity and impermeability to gases, have been especially appreciated as protective tubes for pyrometers, fireproof tubes, &c.

A special form of silite heater is the electrical radiation furnace patented by Messrs. Siemens Bros., in connection with which a heating rod (*e.g.*, of carbon) is so arranged as to be free to expand

Fig. 6.—Slotted Silite Heater.

at least at one end, thus avoiding any variations in form due to excessive heating. This rod is enclosed with a proper interval, in a silite tube as airtight as possible of Group 3. In order to allow this tube also to follow any heat expansion, it is likewise arranged with at least one end free to expand. Atmospheric oxygen must be prevented as far as possible from entering the interior of the tube, lest the heating rod be burnt too quickly. This, in spite of the mobility of the heating rod and tube, is effected by inserting the ends of the rod in relatively long sockets communicating with the tube by an airtight connection. The heating rod and tube may be connected together through the intermediary of an electrically-insulating layer.

An Italian Transaction.—The Siemens-Schuckert Co. has disposed of its tramway in the town of Pisa to the Societa Ligure-Toscana di Elettricita, of Leghorn. The latter now proposes to increase its share capital from £440,000 to £880,000 for the purpose of undertaking other schemes, including the construction of hydro-electric works on the River Serchio, the extension of the network of distributing mains and the conversion of the overland tramway in the province of Pisa to electric traction. It is stated that the Swiss Electrical Industry Co., of Basle, is subscribing for one-third of the additional share capital, whilst the balance will be provided by the old group of financial interests as represented by the Italian Southern Railway Co., which is now an investment company, and by Belgian capitalists. The Ligure-Toscana, which is devoting increased attention to tramway work, paid a dividend of 6½ per cent. for 1912, as compared with 6 per cent. in 1911 and 5½ per cent. in 1910.

NEW HIGH-TENSION MAST CONSTRUCTION.

In three-phase transmission schemes for 50,000 volts and upwards, in which suspension insulators are used, it has hitherto been usual to place two conductors on one side and the third on the other side of the mast—an unsymmetrical arrangement developed in the application of pin insulators (see fig. 1). Messrs. Breest & Co., Berlin, have recently placed on the market the new type of mast illustrated in fig. 2, in which one conductor lies in the mast axis and the others symmetrically on either side of it. This arrangement is made possible by the use of a comparatively light looped structure encircling the top conductor and serving for the suspension of the lower conductors. The appearance of the mast is undoubtedly improved in the new design; this is a point of con-

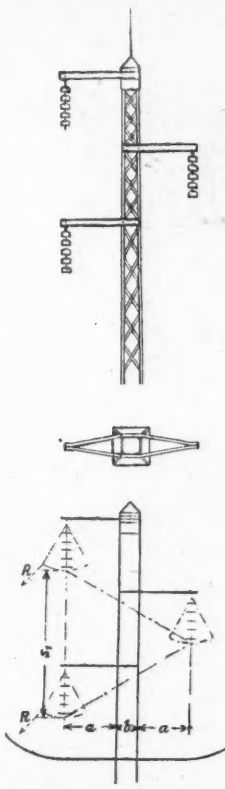


Fig. 1.

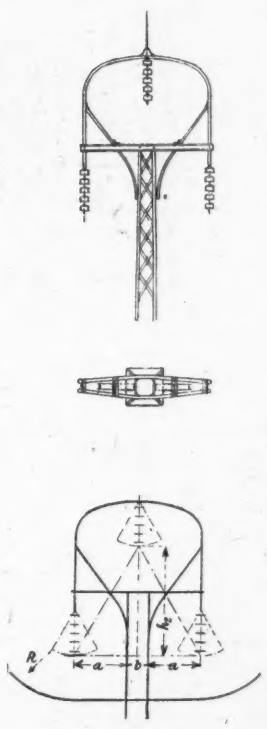


Fig. 2.

siderable importance in the present stage of development of high-tension transmissions, but more substantial advantages are also offered by the new mast.

Where suspension insulators are used, the distance between conductors is primarily determined by the minimum distance which must be maintained between them and the metal work of the mast, allowance being made for the possible swing of the wires. By simple geometrical considerations it will be seen that in fig. 1—

$$s_1 = 2\,(2a + b) / \sqrt{3},$$

while in fig. 2:—

$$h_2 = \sqrt{3}\,(2a + b) / 2, \text{ so that } h_2/s_1 = 3/4.$$

On a 100,000-volt line ($2a + b$) may be 3,000 mm., in which case h_2 = 2,598 mm. and s_1 = 3,464 mm., the difference in height, in favour of the new construction, being 866 mm. This saving is due to the more favourable arrangement of the conductor triangle, and to the smaller size of the latter for a given factor of safety. The reduced height of the mast and the symmetry of its loading results in a considerable saving in constructional materials.

In the new design, the top loop-member forms a perfect earthing frame for the top conductor and a single curved cross-frame, as shown, serves to catch either or both of the lower conductors should the insulators break. The resultant of the weight of a 25 or 50 sq. mm. line, and the maximum wind pressure to which it may be exposed, is inclined at less than 45° to the horizontal, so that a single catch arm on the old type of mast only affords adequate protection to the lowest conductor (see fig. 1); for satisfactory protection, it is necessary, in the latter case, to provide an earthing loop or bracket for each conductor—a costly and unsightly construction. The new construction affords the best possible protection to the top line against damage by lightning.

To avoid the necessity for threading the conductor through the top loop, one joint in the latter is left to be completed after the line (which is first laid out on the ground along the route), has been raised, slipped into the loop and attached to the insulators. Section or strain masts are very similar to intermediate masts

except that they are of heavier build and have no slot in the loop-member for threading the conductor, such provision being here unnecessary since the conductor itself is interrupted at section masts.

ENERGY DENSITY.*

By CHARLES P. STEINMETZ.

While electric energy is the most convenient form to transmit and distribute, there exists no economical method of storing electric energy: the electric storage battery does not store electric energy, but stores chemical energy, by double conversion from electrical to chemical during charge, and from chemical to electrical during discharge. It is thereby limited in economical usefulness. As the result, electrical energy essentially plays the part of the connecting link joining the source of energy—nature's fuel supply or water-power—with the energy consumer.

As energy storage is essential throughout all modern industrial life, the maximum weight and space efficiency which may be reached with the different methods of energy storage are of interest.

Chemical Energy.—1 kg. of hydrogen contains 33 KW.-hour stored chemical energy, which is set free as heat in combustion. 1 kg. of gasolene contains about 13 KW.-hour, and 1 litre of gasolene about 10 KW.-hours of stored chemical energy. 1 kg. of the lightest storage battery contains less than 120 watt-hours of stored energy.

Mechanical Energy.—The highest mechanical energy density obviously is found in the rifle bullet or cannon ball; and, at the highest bullet velocities of about 1,000 m.-sec., represents 0·14 KW.-hour per kg. Thus a tungsten bullet (sp. g. 20) carries nearly 3 KW.-hour per cb. dcm. (litre) of volume—that is, approaches the energy density of chemical storage. Thus the impact of a tungsten bullet approaches the destructiveness of the detonation of the same volume of high explosive. This explains the interest taken in the introduction of tungsten as bullet material.

The highest velocities in rotating machinery are reached in the revolving rim of the steam turbine disk, approaching 200 m.-sec., and representing a stored energy of 5·6 watt-hours per kg. of rim weight.

Hydraulic Energy.—As the highest heads of water-powers, of about 1,000 m., the energy density would be only 2·8 watt-hours per kg. or litre of water, and thus would be less than one-thousandth of the energy density of chemical storage. However, the ease and simplicity of storing large quantities of water in reservoirs make hydraulic storage of economical importance.

Electrical Energy.—Dielectric: At the limits of disruptive strength of the most resisting material, mica, of 1 million volts per cm., the energy stored in the electrostatic field is only 0·05 watt-hour per cb. dcm. or litre, *i.e.*, is insignificant compared even with mechanical storage.

Magnetic: At the highest magnetic densities ever reached in iron (of B = 60,000 lines of magnetic force per cm.^{2}, at H = 40,000) the energy density is 28 watt-hours per cb. dcm. or litre—of about the same magnitude as in the average storage battery.

In power-limiting reactances, under short-circuit conditions, in the air field inside the reactance, energy densities as high as 2 watt-hours per litre are reached.

Electrolytic Disinfecting Fluid.—Dr. F. W. Alexander, the Medical Officer of Health for the Borough of Poplar, in his annual report for 1912, states that at the seven depôts the electrolytic fluid was still in great demand, the output being 54,388 gallons for the 12 months. The cost of material in manufacturing this quantity of fluid was £101 2s. 2½d., made up as follows:—Electricity, 9,555 units at 1½d. per unit, £59 14s.; chloride of magnesium 4 tons, £18; salt, 8 tons 2½ cwt., £13 16s.; caustic soda, £7 16s.; water, £1 12s. The fluid was supplied to four L.C.C. public elementary schools for spraying and cleansing class-room floors, 960 gallons being thus used. In regard to swimming baths, 4,832 gallons were supplied to the Poplar Baths, 5,527 gallons to the Bow Baths, and 1,110 gallons to the Island Baths, and the superintendents of these establishments repeat their statements that the addition of the fluid prevents the formation of slime in the water; the slime is not found at the bottom of the baths when they are emptied, and there is no offensive smell when the baths are being cleansed. Dr. Alexander's statement contains lengthy quotations from a paper by Dr. J. Graham Forbes on "Pollution of Swimming Baths," in which he remarks that, apart from what has been done by Dr. Alexander, the subject of remedying the dangers of infection lurking in our swimming baths has not been seriously met by medical officers. The Royal Sanitary Institute has also appointed a Committee to investigate the question of purifying bath water, and in their report, the Poplar electrolytic process, with the results of which they were very much impressed, is described.

* *General Electric Review.*

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

Imperial" writes:—"I have a client who wishes to light his house from an existing plant at his works close by: to accomplish this it will be necessary to erect an aerial wire across a field and a public road. I shall be glad if you will, through the medium of your "Legal Query" column, answer the following questions:—(*a*) Can an owner object to aerial wires crossing his land, providing no poles or other fixings are attached to his property? (*b*) Can the local authority prevent aerial wires crossing a public road provided that the attachments and supports are on private property? (*c*) Can my client supply and charge for electric current to his neighbours? The works and house in question are situated in a town where gas is supplied by a local company, but there is no electrical supply."

*** As to (*a*) the answer to this question is in the affirmative. An owner of property has a perfect right to prevent any wire being suspended over it, whether supported by posts on his land or not. To stretch a wire over a man's land is to commit a trespass which would be restrained by injunction (see Levy *v.* National Telephone Co., Ltd., *Times*, December 18th, 1897).

As to (*b*) it is difficult to answer this question without more information. Strange to say, while persons or companies supplying electricity under the terms of a provisional order or special Act could not in any event suspend cables over roads without the consent of the local authority, this rule does not apply to a private person, unless some special statute prevents it, or unless the soil of the highway is vested in the local authority.

As to (*c*) the answer is in the affirmative, provided (as seems to be the case) there is no authority supplying electricity in the district (see Electric Lighting Act, 1909, Sec. 23).

Electricity Consumption as a Trade Barometer.—An innovation, as it would appear, in connection with the ascertainment of the upward or downward movements in trade and industry at any particular period is proposed to be periodically undertaken by a Cologne newspaper in the sense of the publication of statistics relating to the monthly consumption of electrical energy in a fairly large area in that part of Germany. The newspaper, which has just made a beginning in this direction, has already secured promises from the managers of a number of works to send in their monthly returns regularly in the future, these comprising all the works in the Government districts of Cologne and Dusseldorf. All these undertakings have forwarded returns for April and May, as compared with the corresponding months in 1912, and the results are set forth as follows:—

Production in the Month of April.

	1912. Kilowatt-hours.	1913. Kilowatt-hours.
Direct current:—		
Output for lighting and power ...	966,611	1,310,075
" " tramway working ...	3,108,597	3,589,075
Alternating current:—		
Output of works	23,870,152	32,478,703
Purchased from outside sources ...	3,165,744	7,845,570
Total	31,111,104	45,223,423

Production in the Month of May.

Direct current:—		
Output for lighting and power ...	920,422	982,096
" " tramway working ...	3,516,240	3,564,635
Alternating current:—		
Output of works	24,846,698	30,741,174
Purchased from outside sources ...	2,985,827	6,826,173
Total	32,269,187	42,114,078

It will be observed that whilst the production in May of the present year indicates a very considerable increase over the equivalent month in 1912, the output and purchase in May experienced a large diminution as contrasted with the preceding month of April. Although the customary decline in the lighting demand in May was slightly responsible for the reduction in the production or consumption, it is concluded that by far the greater portion of the shrinkage in May must be attributed to the slower course of business in trade and industry in the districts concerned. It is, however, impossible to draw definite conclusions on the question at present, as the works frequently do not keep separate accounts for lighting and power consumption respectively. Not only so, but the question of new connections to the distributing systems, especially in cases of the substitution of electric power for steam, gas, or other form of power, has also to be taken into consideration, and the figures have consequently to be accepted with a certain amount of reserve in forming an opinion of the general situation of trade and industry in those districts.

ELECTRICITY SUPPLY CHARGES.

By A. W. B.

With a view of furthering the efforts that are now being made to increase the use of electricity for domestic and other purposes, the following information and curves may be of interest and utility to those publicity engineers and canvassers generally who are attached at the present time, or should be, to all electricity supply stations.

One of the chief uses of the curves will be to give the engineer who is canvassing for a supply, the means to lay before any prospective consumer the approximate amount of his expenditure for a supply of electricity per annum and his average price per unit on any estimated consumption (in the event of the scale of charges for supply not being based on a flat rate), and also a graphic illustration of the fact—"That the more electricity the consumer uses, the cheaper it becomes to him, and therefore the more he can afford to increase the use of a supply when once installed." This knowledge, although one of the axiomatic facts of electricity supply and one which has long been acknowledged inside the central station, has been only recently, or comparatively recently, by means of the maximum demand, Norwich, and similar systems of charging, placed in the hands of engineers and canvassers to be used for the benefit of the general public.

Although systems of charging for electricity apparently vary very widely, the majority should be found, on close examination, to be based on the same principles and in essentials to be practically identical, as, obviously, apart from the flat rate method of charging (which to be at all a fair and equitable method, necessitates the individual careful consideration of every prospective consumer's class of demand and the probable total consumption of current per annum) there can be only one correct underlying method or principle in the first instance on which any universal system of charging for a supply can be based, although, naturally, this first principle can be elaborated widely to suit different localities and conditions.

There have been, in the past, many systems advocated, and in the present and future, probably many more will be brought forward; without prejudice, however, to the numerous other systems of charging, there is little doubt that for general simplicity and universal application the maximum demand and Norwich systems are easily holding their own for the two main classes of supply, viz., bulk and domestic, respectively, at the present time, and therefore this article is based on the application and use of these two systems as being the most representative of a method of charging by system rather than on a flat rate.

Taking first the maximum demand system as the earliest introduced, it is found that the prospective consumer is expected to pay a certain sum annually, a portion of which is allocated to cover the standing charges of the electricity undertaking, the other portion being required to pay for the actual amount of electricity supplied during this period.

Theoretically, the amount required to cover the standing charges (the standing charges is that sum of money which is required annually to pay the interest and sinking fund, or capital charges on the undertaking, the whole of the cost of management, rent, rates, taxes, insurance and distribution, together with a proportion of the wages and maintenance charges of the generating station, such proportion being generally a half) is such a sum as would be obtained by dividing the whole of these standing charges by a figure proportionate to the consumer's maximum demand on the total plant installed; this figure would, however, if actually obtained in this way, be found to be of a varying character, owing to increases in the works plant, balance of plant for stand-by purposes, and possibly a large mains cost incurred in order to reach the prospective consumer, and which would not be of service to the supply authority for other possible consumers, thus rendering a charge based only on this principle more or less liable to constant alteration and error in order to maintain an equitable figure.

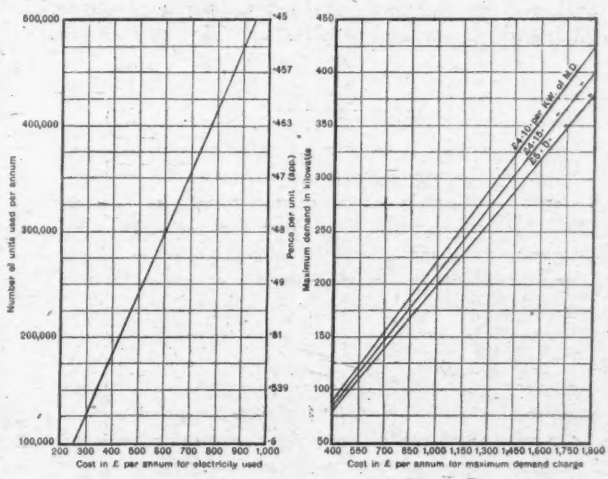
Practically, dealing first with the capital charges, this sum is such as would under modern conditions and prices (thus enabling a competitive figure to be attained) pay for the proportion of plant that would have to be installed to meet the consumer's maximum demand, or, in other words, the charge would be fixed by taking into consideration the cost both of new plant, the already installed plant, and a proportional charge for stand-by plant; as the other charges automatically adjust themselves to any increase in output, no alteration will be necessary and they can be included as before. The only other addition would be the cost of mains to the consumer in a case where the consumer is some distance from the existing mains, which extra charge would be met, either by the consumer paying directly, or by a slight increase in the maximum demand charge until such cost had been liquidated.

In actual practice, such standing charges will be generally found, in the case of stations of moderate capacity, to be covered by an annual charge to the consumer of from £4 10s. to £5 per kilowatt of his maximum demand, such maximum demand not being a momentary overload, but one of, say, 15 minutes' duration; the time limit precludes any dispute which might arise in the event of a short circuit or accident to any motor-driven machine occurring, or anything causing a heavy momentary demand to be registered on the meter.

The next point to be considered is the actual cost of supplying the current, apart from any other costs which have been already incurred and which are provided for in the maximum demand charge; this will be found to vary largely, chiefly according to the cost of fuel and the plant load factor of the station itself, it may therefore be accepted (without going largely into statistics, which are outside the present scope), that the cost of the current supplied will be met by the fuel cost, a proportionate amount of the wages and maintenance charges, together with the oil and engine-room stores generally, added to which would be a fair trading profit, according to circumstances.

Taking an average station having a load factor of 20 per cent. per annum, in a position to buy coal at, say, 10s. per ton and selling about 3,000,000 units per annum, also assuming modern plant, then other things being equal, a further increase of 250,000, 500,000, 750,000 and a million units could be supplied at an approximate average price (pence per unit) of 0·47, 0·445, 0·42, and 0·4 respectively.

Utilising these figures as a basis charge, then the cost of supplying 100,000 to 500,000 units per annum more would be, after allowing a small percentage for contingencies and profit, on a sliding scale of 100,000 units at 0·6d. to 500,000 units at 0·45d. The cost of current per unit for any intermediate number of units used per annum can be readily



Curve A Curve B.

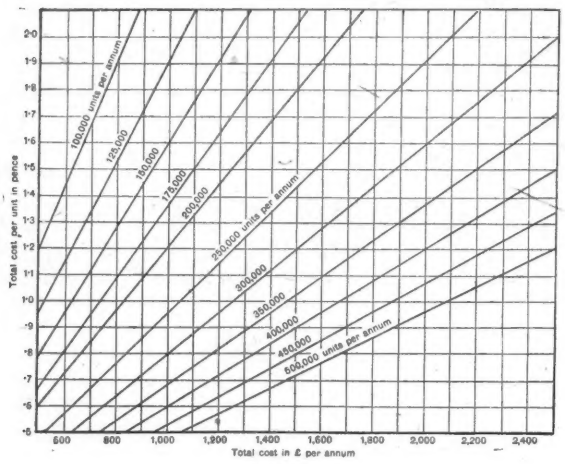
ascertained from the reading on the right-hand side of Curve A.

The curves immediately following are based on these figures, together with the maximum demand charges already mentioned, viz., £5, £4 15s. and £4 10s. per KW.

Curve A shows the annual charges due to a given consumption in units; B shows the annual charges created by a given maximum demand; C is a set of ordinary cost curves

by means of which the total cost per unit may be easily determined ; as an example, it is required to find the total cost per annum and total cost per unit for a supply of 400,000 units on a maximum demand of 130 KW. at the maximum demand charge of £4 10s. per KW., then Curve A shows the cost to be £770 ; Curve B shows a cost of £585 ; therefore, the total cost per annum is £1,355, and over this sum on C, opposite the units per annum curve, is found 0·813d., the required cost per unit supplied.

Turning to the Norwich system of charging for the supply of current for domestic purposes, a practically similar state

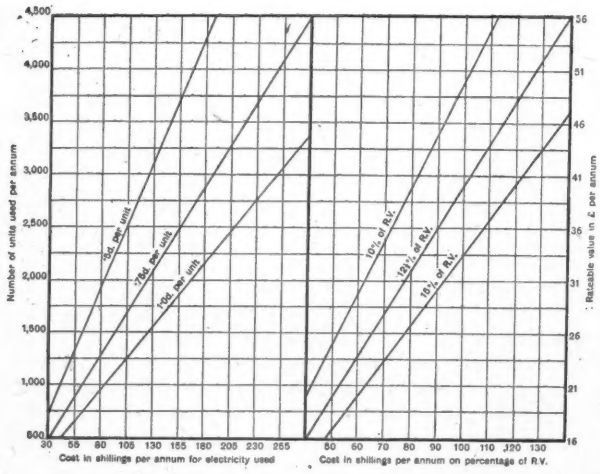


CURVE C.

of affairs exists, with the exception that there is no direct charge for the maximum demand ; but in place of this, there is a variable charge based on the net assessment or rateable value of the house to which a supply is to be given, such variable charge being usually a percentage on the rateable value. In other words, the maximum demand figure is obtained, not of one particular house, but of an average house of that particular rateable value.

Obviously, a varying rateable value differentiates between the grades or sizes of houses, the class of probable consumer and the possible use made of a supply of electricity ; thus there is, to all intents and purposes, a sliding scale, which is, for any particular house, a charge corresponding to the maximum demand charge on a large bulk supply.

This percentage charge naturally varies according to the position of the town in which the supply station is situated, and depends on whether the assessments are high or low as


Number of units used per annum
Cost in shillings per annum for electricity used
Rateable value in £ per annum
Cost in shillings per annum on percentage of R.V.
1½d. per unit
1¾d. per unit
2d. per unit
10% of R.V.
12½% of R.V.
15% of R.V.

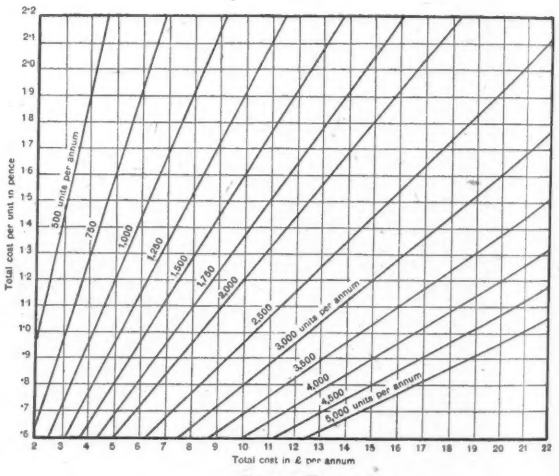
CURVE D. CURVE E.

regards the letting value of the properties, &c ; however, generally speaking, a charge of from 10 per cent. to 15 per cent. on the rateable value has been found sufficient to cover the standing charges of the supply authority for that class of consumer ; after these charges have been met, the actual supply can be given at a very low cost per unit, this latter being also comparable to the cost of current for a bulk supply.

The actual cost of current per unit supplied naturally varies between different towns, as previously shown, but a charge of from 0·5d. to 0·75d. per unit should more than cover the cost of supplying the current for such purposes as a general domestic supply, leaving, say, the mean of the percentage charges on the rateable value (12½ per cent.) to cover the standing charges and margin of profit.

A supply taken on the basis of 12½ per cent. on the rateable value and 0·5d., or even 0·75d. per unit, would provide the average household with "Electricity for Everything," at a cost, taking all the advantages to be obtained from such a general use of electricity into consideration, of from 10 per cent. to 20 per cent. cheaper than the use of gas for illuminating and either coal or gas fires for heating and cooking generally, and to this must be added the convenience of electricity, which, unfortunately, cannot be directly shown as favourably as it should be when dealing with the matter on a monetary basis only.

Again, Curve D shows the annual cost due to a given consumption of current, Curve E shows the annual cost for any given rateable value, and Curve F is a set of cost curves



CURVE F.

framed to meet the curves D and E ; these curves would be used by the canvasser in a similar manner to the maximum demand curves. For instance, given a house having a rateable value of £41 per annum and having an annual consumption of 3,500 units, then on a 12½ per cent. of the rateable value and 0·75d. per unit basis, the total costs could be easily ascertained in a few moments, from Curve E as £5 2s. 6d. plus £10 19s. from Curve D, giving a total annual cost of £16 1s. 6d. at an average total cost per unit for *lighting* and all other purposes of 1·1d., which cost is obtained from Curve F, as shown previously.

New Units.—At the recent Convention of the National Electric Light Association, in Chicago, the Committee on Measurements favoured the adoption of the myriawatt, about which there had been considerable debate during the past year. The advantage associated with such a step was held to be that of a unified system of measuring both the input and the output of steam engine generator sets, making the important item of efficiency more readily apparent. The use of the term "Kelvin" to displace the established KW.-hour was opposed on the ground of ambiguity, and because Lord Kelvin's name is being proposed for an important electrostatic unit.

Dr. C. P. Steinmetz deprecated the addition of units of a hybrid character to the nomenclature of the electrical industry, contending that the existing supply appeared adequate for present needs. The proposed "myriawatt" for boiler rating was a makeshift unit, and one might as well use the kilowatt or the megawatt. Even the adoption of the term "Kelvin" for the KW.-hour had not found large acceptance, because it was a mixture of units of different characteristics and not an absolute unit on account of the hour factor.—*Electrical World.*

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A VERY successful convention of the Canadian Electrical Association was held in Toronto recently. This Association is affiliated with the National Electric Light Association of the U.S.A., and as such bars all men connected with municipally-owned works from its membership. There is now a movement on foot to extend the scope of the Canadian Association so as to include municipal men.

A plea has also been put forward recently for the formation of an Institution of Municipal Engineers, which should include electrical engineers, and another proposal, as an amendment to this, recommends that the municipal engineers be enrolled as a new section of the existing Canadian Society of Civil Engineers.

In a paper read in June, by Dr. W. W. Andrews, on "The Scientific Utilisation of Natural Resources," before the Union of Saskatchewan Municipalities, the possibility of utilising the enormous quantities of straw in the West, for power production, was dealt with. The author's personal analysis of the straw was as follows :—

Volatile hydro-carbons, 64 to 72 per cent.
Moisture, 6 to 10 per cent.
Fixed carbon, 21 to 24 per cent.
Ash, 6·5 to 8·2 per cent.

The paper goes on to say : "It is found that slight charring of the straw solves the problem of reducing the straw to a powder fine enough for briquetting, and also that pulped potatoes form an excellent binder. . . . It will thus be seen that the farm may not only produce all the fuel necessary for household and power purposes, but the small towns or villages may be supplied with fuel from the neighbouring farms.

"How enormous the possibilities are will be shown from the following :—Suppose we think of a square 40 miles each way, with Regina as the centre. If 24,000 acres be left out for the city and vacant places, and supposing that one-half of the remaining area is given to grain crops, 250,000 tons of this fuel may be produced every year for all time, nearly all of this coming from a distance of less than 20 miles from the city."

Though the author does not touch on this point, there is no doubt that such fuel could be used in gas producer plant to economically generate electric power for use in the district.

The Winnipeg Board of Control is considering the electrification of the waterworks high-pressure pumping plant, which is at present operated by gas engines. The estimated cost of the change is about £10,000, and it is calculated that this would soon be saved by eliminating the cost of keeping up the fires for the producer plant.

The Commission of Conservation is preparing a report on the water power of Western Canada, in which a great deal of information will be given respecting the water powers of British Columbia. The mainland coast and the vicinity of the Grand Trunk Pacific Railway are receiving attention at present, presumably because these will be the most accessible and best situated regions for immediate development.

The city of Brandon in Manitoba is just about completing the electric tramway system, and it is expected that the cars will shortly be running. A by-law has recently been passed authorising expenditure amounting to £30,000 on extensions.

In these notes there was recently a brief account of a report by a consulting engineer on the subject of additional power for the Calgary Electricity Works. Apparently at least one of the recommendations of this report has been adopted, as a by-law has been passed authorising additions, including gas-fired boilers and turbo-generators of 6,600 H.P. capacity.

The town of Grenfell, Saskatchewan, proposes to spend about £3,000 on an electric lighting plant and will vote on a by-law shortly.

The Medical Officer of Health of Toronto has just issued a set of regulations respecting the trams and other public conveyances. The number of passengers to be carried is limited to one and two-fifths of the total seating capacity. Each tram is to be provided with a Fahrenheit thermometer and no cushions on the seats or backs will be allowed except such as can be readily cleansed and disinfected. Efficient ventilation and heating are to be provided, and all the straps must be composed of, or covered with, celluloid or other non-absorbent material.

The Provincial Board of Health must approve the regulations before they can be properly put into force.

Anyone who has travelled on Toronto trams during the rush hours will endorse the policy of the M.O.H. as being a very good move in the right direction. The extent of overcrowding at present allowed is extremely dangerous, especially to the public health, and more particulary so in winter, when owing to the extreme cold the cars are kept very much closed up and often greatly overheated—the atmosphere is sometimes like that of a foul den.

Owing to the recent failures of the transmission lines of the Hydro-Electric Power Commission, the question of an emergency plant for Toronto has been taken up, and a joint report was made a few days ago by the Commission's chief engineer and the new general manager of the Toronto hydro-electric system, Mr. Couzens, who has recently arrived from England, in which the provision of a plant for emergency and peak load purposes was recommended. The use of both steam and oil engine-driven sets will be considered, the probable capacity of the plant being in the neighbourhood of 20,000 KW.

It is understood that the city of Hamilton is also taking up a similar question.

The Mainsman's Nightmare.

A sinuous Network held me fast,
  Thrown round me by the Genius of the Mains,
And thro' the meshes grimaced vast
  Armies of Faults, like little stabbing pains.
Upon my chest there sat a Kit
  Of Jointer's tools, pouring hot compound down
My throat, which, parchéd as the Pit,
  Felt like a Furnace Flue. Then did I drown
In scalding Insulating Oil,
  Which closed around my horror-stricken head,
Whose hair electrified did coil
  In snaky spirals, then turned cherry red,
And stood straight out like prickly quills
  Upon the fretful porpuntine. A Mob
Of Megohms danced like Whip-poor-wills ;
  And then methought I lost my blighted job,
And all the mains on earth went dead,
  Then blew up with a frightful, fearful shock,
And fifty thousand guns struck one o'clock,
  And half a million lamps crashed to the ground,
Till all the vibrant earth reeled round,
  Re-echoing with elemental sound.

* * * * *

Here I awoke in horrid sweat, and found
The cheap alarm clock had gone off its head,
And it was 8 a.m., and I abed.

J. A. M.

In *Glover's Almanac.*

Resuscitation from Electric Shock.—The report of a Commission on resuscitation from electric shock to the N.E.L.A. Convention, stated that so far as the amount of ventilation of the lungs was concerned, the Schaefer method, reinforced by the extension of the arms forward, was decidedly better than that suggested by Silvester. This advantage, taken in conjunction with its greater simplicity and safety, caused the Commission to vote unanimously in favour of the prone-pressure method of artificial respiration as an effective means of giving immediate aid. A booklet on resuscitation has been prepared as the outcome of the work.

Even a relatively poor method of artificial respiration, if begun immediately, may maintain life and permit ultimate recovery in cases in which an ideal method, with all the resources of the laboratory and hospital, would be ineffective after a few minutes. The Committee emphasised the wide publicity which the "pulmotor" had received through the daily Press, but pointed out that the pulmotor had lacked scientific, surgical and medical sponsors. Efforts to obtain scientific details and other reliable information bearing upon specific cases in which the pulmotor had been used, led to the conclusion that the cases available to the Committee did not furnish convincing proof of the necessity or exceptional value of this apparatus.

The report described the mechanical method of artificial respiration used by Dr. Metzler, which has commendable features. The Commission recommended this apparatus as a satisfactory means of continuing artificial respiration, and suggested that in cases of suspended breathing the modified prone-pressure method be supplemented as soon as possible by the use of the apparatus.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,151. "Switches of the tumbler kind." W. J. Charles. (Divided application on 22,477, 1912, April 3rd, 1913.) July 14th. (Complete.)

16,160. "Dynamo-electric machines." J. H. Gath. July 14th.

16,167. "Direct-current and alternating-current electric motors." H. H. Jowers. July 14th.

16,198. "Electrically-operated rotary constant-speed device." R. P. Howgrave-Graham. July 14th.

16,202. "Apparatus for the support of the receivers of table telephone instruments." A. Bonnin. July 14th.

16,208. "Controllers for electrical apparatus." A. Mond. (Maschinenfabrik Oerlikon, Switzerland.) July 14th.

16,214. "Electric heating apparatus for water and other fluids." H. de Kok. (Convention date, November 30th, 1912, Germany.) July 14th. (Complete.)

16,248. "Electric glow-lamps." G. Zahikjanz, S. Gatman and G. van Zwonenberg. July 15th.

16,254. "Electrical lamps." J. Ernst and C. Endre. July 15th.

16,257. "Electric miners' lamp with fire-damp indicator." J. C. Rigaux. July 15th.

16,262. "Device for transferring pressure from rigid bodies to electric insulators." M. Hedlund. July 15th. (Complete.)

16,267. "Telephone exchange systems." Western Electric Co., Ltd. (F. T. Woodward, United States.) (Divided Application on 1,902 of 1913, January 23rd). July 15th. (Complete.)

16,268. "Circuits for electric signalling." A. Orling and Orling's Telegraph Instruments Syndicate, Ltd. July 15th.

16,269. "Means for and methods of changing the frequency of alternating electric currents." A. M. Taylor. July 15th.

16,297. "Syrens for submarine signalling." Signal G.m.b.H. (Convention date, July 29th, 1912, Germany). July 15th. (Complete.)

16,298. "Receivers for submarine sound signals." Signal G.m.b.H. (Convention date, July 29th, 1912, Germany.) July 15th. (Complete.)

16,299. "Refractory fibrous material and process of making the same." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 15th.

16,341. "Electric arc lights." J. T. Morris. July 16th.

16,344. "Counting trains for electricity meters." A. Mascall and Chamberlain & Hookham, Ltd. July 16th. (Complete.)

16,349. "Electrical stop-motions for knitting and like machines." G. Stibbe. July 16th.

16,376. "Prepayment devices for telephone systems." Siemens & Halske Akt.-Ges. (Convention date, July 17th, 1912, Germany.) (Complete.)

16,384. "Electric heating and cooking apparatus." H. H. Cressall. July 16th.

16,391. "Cooling electrical machines." Allgemeine Elektricitats Ges. (Convention date, July 16th, 1912, Germany.) July 16th. (Complete.)

16,392. "Electric dinner or service lifts." F. Hodgson. July 16th.

16,403. "Replacement fuses for electric circuits." G. O. Donovan. July 16th.

16,413. "Railways safe-running devices." A. R. Angus. July 17th.

16,428. "Electro-motors for portable electric drilling machines." G. F. D. Campbell. July 17th. (Complete.)

16,435. "Duplex telegraphy and the like." H. G. Barwell and Eastern Telegraph Co., Ltd. July 17th.

16,438. "Method of, and means for, firing submarine mines and torpedoes." A. C. E. Rateau. July 17th. (Complete.)

16,454. "Electric switches." Siemens-Schuckertwerke G.m.b.H. (Convention date, June 7th, 1913, Germany.) July 17th. (Complete.)

16,468. "Processes for making boron nitride." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) July 17th.

16,474. "Illuminated advertising apparatus." E. Buhlmann, Jun. (Convention date, September 24th, 1912, Germany.) July 17th. (Complete.)

16,481. "Process of manufacturing a cobalt electric lamp-filament." C. Kanazawi. (Convention date, July 17th, 1912, Japan.) July 17th. (Complete.)

16,485. "Electric and gas radiator." V. Lacasse. (Convention date, July 17th, 1912, Belgium.) July 17th. (Complete.)

16,526. "Dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., and G. H. Taylor. July 18th. (Complete.)

16,538. "Automatic and semi-automatic telephone systems." Siemens and Halske Akt. Ges. (Convention date, September 10th, 1912, Germany.) July 18th. (Complete.)

16,540. "Electro-deposition of iron." S. O. Cowper-Coles. July 18th.

16,541. "Process for the electro-deposition of lead." S. O. Cowper-Coles. July 18th.

16,542. "Process for coating or plating metal sheets with other metals." S. O. Cowper-Coles. July 18th.

16,565. "Manufacture of electrolytic iron." Societe "Le Fer." (Convention date, August 2nd, 1912, France.) July 18th. (Complete.)

16,566. "Magneto-electric ignition apparatus adapted for use in connection with internal-combustion engines." G. G. M. Hardingham. (Mafam Motor Apparate G.m.b.H., Germany.) July 18th. (Complete.)

16,584. "Starting devices for switches of electric motors." T. Knight and J. R. Maule. July 19th.

16,601. "Apparatus for heating liquids electrically." British Electric Heater Co., Ltd., and C. Kratt. July 19th.

16,609. "Means for operating electrical switches." Mackenzie Drysdale and Displayer Co., Ltd. July 19th.

16,641. "Indicating recording and controlling devices." Soc. de L'Elektricite Nilmelior and E. Colas. (Addition to 827/10. Convention date, July 20th, 1912, France.) July 19th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Apparatus for Electric Sterilisation of Closet Seats and the Like. K. Gasiorowski. 26,485. November 18th.

Electro-magnets for Producing Mechanical Movements. K. Miram. 27,922. December 4th. (December 4th, 1911.)

Dynamo-electric Machines. Electric Construction Co. and N. Pensabene. 7,651. March 29th.

Electrical Winding Gear for Clocks and the Like. L. J. Aron and C. Wiener. 9,154. April 18th. (June 29th, 1912.)

Telephone Systems. H. P. Clausen. 15,057. June 27th. (March 11th, 1912.)

Control Gear for Naval Ordnance. E. Saqui and S. A. Farrell. 15,279. July 1st.

Telephone Exchange Systems and the Like. W. Aitken. 15,292. July 1st.

Filament-Supporting Devices for Incandescent Electric Lamps. Julius Pintsch Akt.-Ges. 15,486. July 2nd. (November 21st, 1911.)

Railway Signals. R. H. Stockdale. 15,548. July 3rd.

Electrical Distribution Junction Boxes or Apparatus. British Insulated and Helsby Cables, Ltd., and H. Allwood. 15,706. July 5th.

Electric Toasters and the Like Devices. E. C. R. Marks. (Landers, Frary & Clark.) 15,961. July 8th.

Means for Electrically Lighting Road Vehicles or other Rolling Stock. L. Krebs. 16,024. July 9th.

Apparatus for Testing Electrical Measuring Instruments. G. North. 16,730. July 17th.

Thermal Switches. A. McPherson. 20,464. September 9th.

Electrical Terminals. H. G. Longford and W. A. Clark. 20,775. September 12th.

Electrical Incandescent Lamps. H. F. J. Truss. 23,453. October 14th.

Magnetic Speedometers. R. Haddan. (Stewart & Clark Manufacturing Co.) 23,597. October 15th.

Manufacture of Metal-filament Electric Lamps. W. L. Pakenham. 24,861. October 24th.

Electro-magnetic Separators. Maschinenbau-Anstalt Humboldt. 24,643. October 28th. (October 27th, 1911.)

Locking Devices for the Gates or Doors of Electrically-controlled Lifts and the Like. F. Barlow. 25,258. November 4th.

Watertight Insulating Plug for Submersible Vessels. Siemens Bros. and Co. and W. D. Le Corney. 28,646. December 12th.

Automatic Apparatus for Controlling the Period of Artificial Illumination. J. H. Gill. 29,928. December 30th.

1913.

Time Switches for Electrical and other Purposes. H. F. J. Thompson and J. H. Bowden. 1,496. January 18th.

Speed Control of Prime Movers. Siemens-Schuckertwerke Ges. 1,596. January 20th. (January 19th, 1912.)

Control of Electric Motors for Driving Screw Propellers. Siemens-Schuckertwerke G.m.b.H. 2,136. January 27th. (January 27th, 1912.)

Electromagnetically-Operated Diaphragms for Producing Sound. E. A. Graham. 4,197. February 18th.

Railway Safe Running Devices. A. R. Angus. 6,330 and 6,652. March 22nd. (Divided application on 7,081 of 1912. March 22nd.)

Electric Motors Applicable for Driving Kinetographs. I. Kitsee. 10,519. May 5th. (Divided application on 14,880 of 1912. June 26th.)

Apparatus for Transmitting Movements or Positions of Indices by Means of Multiphase-wound Bodies. E. Beckmann. 130. January 2nd.

Method of Reducing Telephonic Disturbances. O. B. Blackwell and G. A. Anderegg. 2,508. January 30th.

Electric Transformers. Claudius Ash, Sons & Co., Ltd., A. B. Jones and W. G. Lee. 2,697. February 1st.

Electro-magnetic Service Meter for Telephone Exchanges and for other Purposes. Siemens Bros. & Co., Ltd., and E. A. Petithory. 2,752. February 3rd.

Accumulator Traction on Prussian Railways.—

After careful tests extending over several years, the Prussian State Railway authorities are steadily increasing the number of accumulator-driven cars on their lines. In 1907 only six such cars were in use, whilst now the number has increased to 200. Without any revolutionary change in design or construction, the possibility of using accumulators successfully for this purpose has thus been established in a striking manner. By means of maintenance arrangements with the accumulator manufacturers the financial risks to the users are reduced to a minimum, and enable an exact predetermination of the cost per car-mile to be arrived at. The energy required for charging is produced under the most favourable and economical conditions. Under these circumstances, a cost of not more than ·7d. per KW.-hour can be counted on, and, allowing 70 per cent. for the (watt) efficiency of the battery and 85 per cent. for that of the motors, the cost per H P.-hour at the wheels works out at only about ·87d.—a price which neither benzine-electric cars nor the ordinary steam locomotive can approach.

The Prussian Railway results also enable some idea as to total cost to be arrived at. The accumulator cars consist of two distinct wagons connected by a coupling, and are capable of carrying a total of 100 passengers. The Tudor accumulator battery is placed in two compartments—one at the point of the double car, and one at the back. Of the six wheel axles two are fitted with motors. Each motor is rated at 85 H.P., and the battery is of sufficient capacity to cover a journey of 100 km. (62 miles) without recharging. The speed attained on the level is 37 miles per hour, and 22 miles per hour on a 2·5 per cent. gradient. The weight of the car complete, but without passengers, is 55 tons, of which 17½ tons is for the accumulators. The cost of the car is about £3,600.

The energy consumed is very moderate—amounting to about 2·3d. per car-mile, if as much as 1d. per K.W.H. is allowed for the cost of current. The total cost per car-mile, allowing for operating cost, maintenance, interest on capital and amortisation, amounts to about 8½d. Even if the cost of energy were doubled the total cost would work out cheaper than that for benzine-electric cars, recent tests on which have shown a cost of something like 12¼d. per car-mile.

With steam traction the cost is so high that two accumulator cars could be run for the same amount. The chance of doubling the train frequency without increased cost should greatly aid in popularising accumulator traction on railways.—*La Technique Moderne.*